

MARCH 2026

EMERGING
VOICES
NETWORK

BASIC



Assembling peace through dialogue

■ **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.

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), 2026

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 any prior written permission of the copyright holder.

Please direct all enquiries to the publishers.

Image credits: Balon Greyjoy, CC0, via Wikimedia Commons / Patricia Haller-Anguela via Unsplash / Nikolay Kondev, CC0, via Pxhere / Fritzchens Fritz, CC0, via Flickr / pacyopi, CC BY-SA 3.0, via Wikimedia Commons / NASA Goddard Space Flight Center, CC BY 2.0 via Wikimedia Commons / Annie Spratt via Unsplash

Editorial team

- Dave Cullen
- Chiara Cervasio
- Kazuko Hikawa
- Declan Penrose
- Chiara Fagnoli

PCU-NC

On October 4, 2012, Nagasaki Prefecture, Nagasaki City and Nagasaki University established the PCU Nagasaki Council for Nuclear Weapons Abolition (PCU-NC) as a new framework towards a world free from nuclear weapons. This is a reflection of the wish of citizens living in Nagasaki Prefecture and Nagasaki City that Nagasaki should be the last city in human history which has been subjected to a nuclear attack. PCU-NC constitutes of Nagasaki Prefecture, Nagasaki City and Nagasaki University as regular members and Nagasaki Foundation for Promotion of Peace and Nagasaki National Peace Memorial Hall for the Atomic Bomb Victims as special members.

RECNA

Nagasaki University is the only university in the world that has inherited a medical college having experienced the atomic bombing. Achieving a “world free from nuclear weapons” is thus a paramount concern to the University. The Research Center for Nuclear Weapons Abolition, Nagasaki University (RECNA), located in a city that was attacked by an atomic bomb, is an educational and research institute which is the interdisciplinary center of local academia with a firsthand experience of the horror of nuclear weapons. As a think tank open to the local community longing for nuclear weapons abolition, RECNA operates in close cooperation with partners, including Nagasaki City and Nagasaki Prefecture.

Acknowledgements

This has been a truly collaborative project that would not have been possible without the help and support of many people. The editorial team would like to thank the PCU Nagasaki Council for Nuclear Weapons Abolition and all at Nagasaki Prefecture, Nagasaki City, and Nagasaki University for their generous support and for sponsoring the project. We are greatly indebted to our colleagues at RECNA and BASIC for all their assistance with the project, but particularly to the mentors at RECNA for their hard work and insight. Lastly, our sincere thanks and congratulations to all the project participants on completing a really excellent publication.

Contents

Introduction	6
WORKING GROUP 1	
Leveraging Dialogue to Promote Global Governance of Emerging Technologies to Reduce Nuclear Weapons Risk	8
WORKING GROUP 2	
The Role of Kataribe Oral Storytelling in a Post-Hibakusha Nagasaki	19
WORKING GROUP 3	
The Tale of Fire and Ice: Communicating The Nexus Between the Twin Existential Threats of Climate Change and Nuclear Weapons	31
About the Participants	42
List of Acronyms	47

The working groups were each tasked with answering specific research questions and authored three policy papers under the overarching theme:

What is the responsibility that each generation must assume to protect humanity and the planet from risks, including nuclear weapons?



Introduction

This report is the culmination of eight months of work by three international working groups who came together to mark the 80th anniversary of the end of the Second World War, and the atomic bombings of Nagasaki and Hiroshima in August 1945.

This project, “Assembling peace through dialogue”, is a collaboration between the PCU Nagasaki Council for Nuclear Weapons Abolition (PCU-NC), the British American Security Information Council (BASIC), and the Research Center for Nuclear Weapons Abolition, Nagasaki University (RECNA). Each working group was composed of members of BASIC’s Emerging Voices Network (EVN) and Japanese students, who worked collaboratively on their policy papers, supported by staff members from BASIC and mentors from RECNA. Representing five continents and spanning ten different time zones, our participants brought a truly global perspective to some of the most urgent questions facing the world today.

PCU-NC is a consortium of Nagasaki Prefecture, Nagasaki City, and Nagasaki University. It was established in 2012 as a new framework in Nagasaki aimed at promoting a world free from nuclear weapons. To commemorate the 80th anniversary of the end of the war and the atomic bombings, PCU-NC decided to launch an international peace human resources development project, “Assembling peace through dialogue”, in cooperation with BASIC. As the number of atomic bomb survivors is decreasing year by year, and as public interest in the issue of nuclear weapons is also waning year by year, this project is conceptualized as a Nagasaki-based endeavor aimed at fostering imagination and empathy on nuclear issues through constructive dialogue. RECNA is providing support for this project in its capacity as a research institute affiliated with Nagasaki University.

BASIC is an independent, non-profit think tank that works to safeguard humanity and Earth’s ecosystem from nuclear risks and interconnected security threats. This project is jointly managed by BASIC’s Responsibilities and Global Governance (RGG) and EVN programmes. The EVN is an online global network of over 370 young experts from 78 different

countries that brings together the most promising early-career nuclear policy researchers to work together to address issues of common concern. The RGG Programme works to support the development of responsible governance frameworks for weapons and dual-use technologies to advance multilateral governance across inter-state relations and the global commons, in ways that enhance security for all.



In responding to their different questions, the three working groups each pursued distinctive and novel approaches, resulting in papers that are each fresh and unique in tone as well as content:

- **Paper 1:** How can we ensure that emerging technologies reduce, rather than increase, nuclear risks? How can these technologies be integrated into nuclear systems in a responsible way?
- **Paper 2:** How can we best educate the public on Nagasaki’s experience of a nuclear bombing and forever remember and meaningfully commemorate the lives and memories of the Hibakusha for future generations? What responsibilities does the new generation have to preserve this memory?
- **Paper 3:** How can we increase public and political awareness that climate change and nuclear weapons are inexorably linked? What responsibilities does each generation have in protecting humanity and the planet from risks arising from the climate-nuclear nexus?

Beyond their surface differences, the three papers demonstrate common anxieties as well as some optimism. There is a palpable concern about the relationship between human beings and technological advancements. Are current institutions and systems of governance capable of properly managing the risks, reducing the drawbacks and maximising the benefits of developing technologies? The three papers propose multiple policy recommendations for addressing shortfalls in this area. Similarly, throughout the three papers the reader can trace a shared fear that the international system seems to be turning away from the path towards peaceful coexistence and collective problem-solving. Nevertheless, all three working groups are united in their response to these problems: a reaffirmation of the importance of human connections, human agency, and dialogue.

The papers also share more immediate themes. Risks stemming from the use of Artificial Intelligence (AI) in nuclear decision-making are the central focus of Paper 1, and AI custodianship of the memory of Nagasaki's nuclear bombing is discussed in Paper 2. As we progress through the 80th year of the atomic age, it is easy to draw parallels between the genesis of nuclear weapons and current developments in the integration of AI into military and nuclear systems. States and other actors who are pushing for the military use of AI are driven by the perceived advantage they would gain by being first, but have they seriously understood the implications of a world where multiple other actors have similar capabilities? As Paper 1 argues, there is a serious risk that competition fueled by the desire to maintain a perceived technological lead undermines opportunities for international dialogue on governance and regulations of AI in the military and nuclear realm.

Paper 2 considers the potential use of AI in one specific context: a project to create an AI storyteller to share the memories of Hibakusha in Nagasaki. Although the implications are less global than the question of integration into weapons systems, it remains a highly complex moral quandary: can AI be relied upon as a custodian of collective memory? The working group does not dismiss the idea, though they ultimately remain convinced of the importance of retaining the human element, and seek to conserve and enlarge the Japanese Kataribe storytelling tradition. This focus on the importance of storytelling is shared with Paper 3, which highlights its role in effective communication about the twin existential threats of nuclear weapons and climate change. Respect for the voices and lived experience of Hibakusha is another common thread between these two papers, with Paper 3 suggesting that the moral authority of Hibakusha as trusted messengers extends beyond the history of the bombings and could encompass other existential risks.

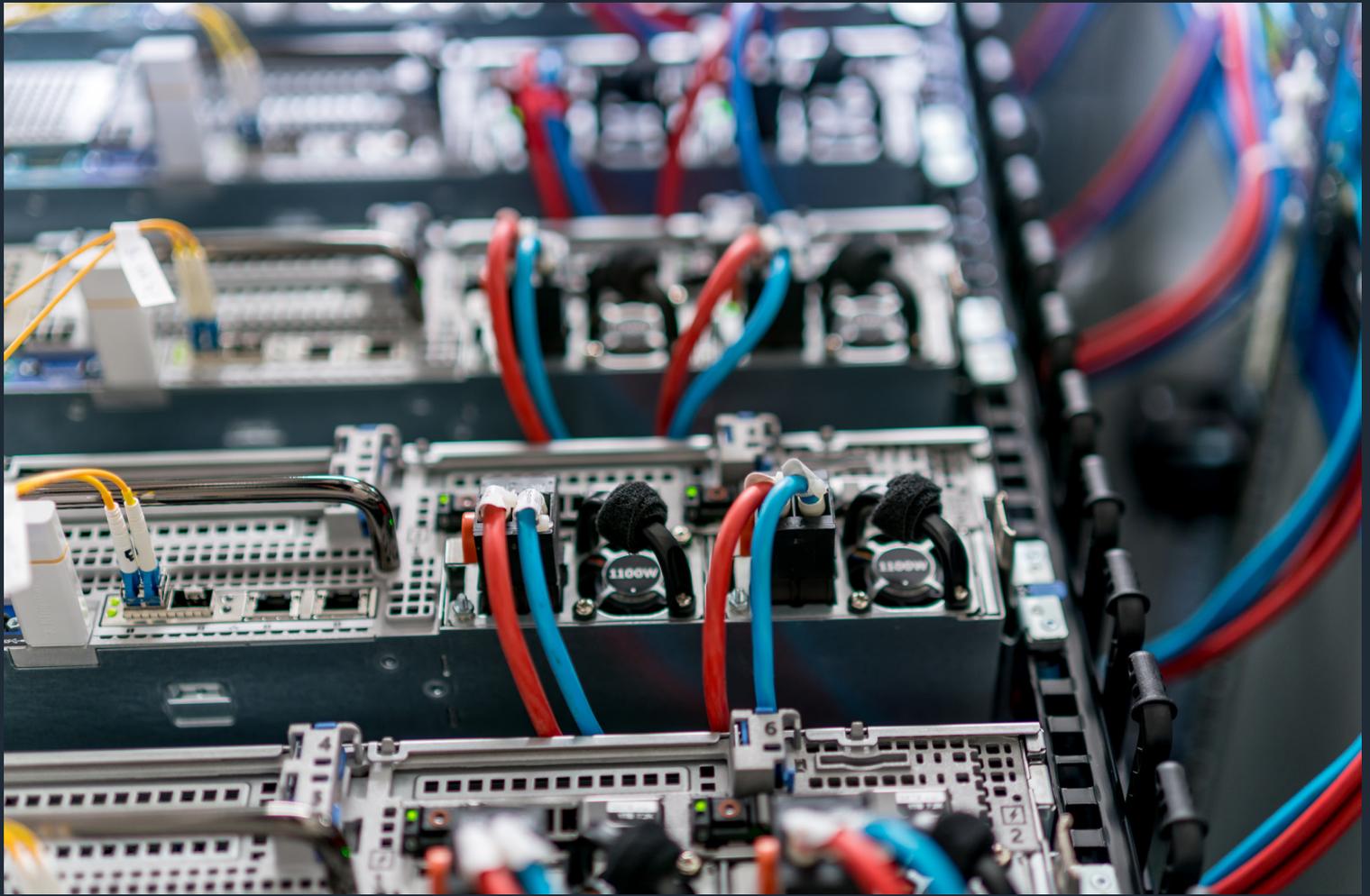
One difference between the three papers is that their recommendations are, in general, oriented towards different levels of governance. Paper 2, with its particular focus on Nagasaki, understandably recommends measures that could be enacted by the local government. Conversely, Paper 1 is predominantly focused on the intergovernmental governance of AI, and Paper 3's recommendations span both national and international governance. These distinct approaches naturally arise from the different research questions addressed by the papers, but as editors we encourage the reader to consider whether there are additional actions that can be taken at other levels, and what we as humans can collectively do to live up to our shared responsibility to protect humanity and the planet from risks associated with nuclear weapons.

As a starting point, all three papers highlight the importance of dialogue as a key mechanism for avoiding the mistakes of the past and achieving durable peace, nuclear disarmament, and risk reduction.

Paper 1, for example, recommends developing agreed norms of responsibility around the military use of AI through a multi-layered process of dialogue. Without establishing a common understanding of the different approaches, meanings, and intent of different stakeholders, any attempt at global governance of AI and other emerging technologies is doomed to failure.

Paper 2 calls for Hibakusha to be involved in a consultative dialogical process on whether AI should have access to their testimonies, and Paper 3 recommends sustained dialogue on the nuclear-climate nexus through multi-stakeholder platforms. Many other recommendations in the three papers implicitly involve dialogue mechanisms or could be made more effective through dialogue.

In a way, this whole project is centred on the idea of international and inter-generational dialogue, as reflected in the global composition of the working groups and the collaboration of institutions located in very different areas of the world. Participants in this project have demonstrated a strong commitment to the principle of dialogue through their collaborative authorship and sustained engagement throughout these eight months. We are delighted to publish their papers as a testament to the fundamental need for us all to understand each other's human stories, because in the end, there is no substitute for human exchange, communication, and connection.



WORKING GROUP 1

Leveraging Dialogue to Promote Global Governance of Emerging Technologies to Reduce Nuclear Weapons Risk

GROUP MEMBERS:

Sathchidha Pachiappan
Kudakwashe Mapako
Morgan Slessor
Kokoro Nishiyama
Kosei Yamashita
Kazuki Noda

Introduction

While technological advancements offer significant benefits, their application, particularly in the realm of nuclear weapons, necessitates careful consideration of human oversight and accountability.

Human perception and the potential for misjudgment, often exacerbated by overreliance on or misunderstanding of new technologies, introduce inherent uncertainties that can fuel mistrust and escalation. Incorrect perceptions on the part of policymakers and military officers, due to excessive belief in new technologies or readiness to attribute failures to them, increase these risks.¹

Emerging technologies are not entirely novel in their individual components. Still, their unprecedented scale of deployment, integration into complex networks, and interaction within nuclear systems risk creating new and destabilising nuclear risks. These range from technical failures and cyber manipulation to compressed decision-making timelines, misperception, and entanglement between conventional and nuclear forces. The dangers affect both nuclear weapon states (NWS) and non-nuclear weapon states (NNWS), though in distinct ways.

Against this complex backdrop, this paper directly addresses a central inquiry: How can we ensure that emerging technologies reduce, rather than increase, nuclear weapons risk, and how can they be responsibly integrated into nuclear systems?

Considering that the prospect of robust regulatory and arms control systems remains limited, this paper argues that dialogue can play an important and complementary role in nuclear weapons risk governance in the context of new technologies. When structured as continuous and inclusive engagement, dialogue can proactively clarify strategic objectives, dispel

¹ Thomas Kessler, Kyle Stowers, J. C. Brill, and Peter A. Hancock, "Comparisons of Human-Human Trust with Other Forms of Human-Technology Trust," *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 61, no. 1 (2017): 1303-1307, <https://doi.org/10.1177/154193121360180era8>.

misconceptions, and foster trust among diverse state and non-state actors, thereby reducing the risk of miscalculation and escalation. While not a substitute for regulation, dialogue is an essential instrument for managing nuclear weapons risk, uncertainty, and preventing escalation in an era of rapid technological development. This is particularly critical, given the inherent secrecy surrounding the military applications of emerging technologies and the often slow pace of formal arms control negotiations, leaving dialogue as a primary mechanism for building understanding and confidence.

As highlighted in the other papers in this report, sustained dialogue and human communication remain the key mechanisms for achieving durable peace and for reducing the harms and risks associated with nuclear weapons. While other contributions focus on the importance of communicating Hibakusha testimonies through storytelling, or on effectively conveying to the public the risks arising from the climate-nuclear nexus, this paper examines dialogue as a structured, intentional process through which states, civil society, technical experts, and other key stakeholders preserve human judgment and agency in nuclear decision-making. In an era of Artificial Intelligence (AI)-enabled and opaque technological systems, dialogue enables meaningful human control (MHC), mitigating automation bias and misperception and translating technical complexity into humanly intelligible assessments. The central theme is once again the role of inclusive, meaningful communication — across societies, generations, and political divides — in fostering responsible efforts to mitigate nuclear weapons risks.

The paper proceeds as follows. It first outlines a working definition of "emerging technologies" in the nuclear field and identifies how these technologies may increase the risk of nuclear weapons use (Section 1). It then proceeds to discuss the opportunities and challenges of the AI-nuclear weapon nexus² (Section 2). Finally, the paper proposes a framework for the integration of responsible AI through five key policy recommendations (Section 3).

² The AI-Nuclear nexus refers to the integration of artificial intelligence across nuclear weapons systems, including command, control, and communication infrastructure, warheads, delivery vehicles, and platforms. See Fei Su, Vladislav Chernavskikh, and Wilfred Wan, *Advancing Governance at the Nexus of Artificial Intelligence and Nuclear Weapons*. (Stockholm: Stockholm International Peace Research Institute, 2025), <https://doi.org/10.55163/ONLB7070>; Jacob Stokes, Colin H. Kahl, Andrea Kendall-Taylor, and Nicholas Lokker, *Averting AI Armageddon* (Washington, DC: Center for a New American Security, 2025), <https://www.cnas.org/publications/reports/averting-ai-armageddon>.

Risks and Opportunities Associated with Emerging Technologies

Defining 'Emerging Technologies' in the Nuclear Field

There is no universally accepted definition of *emerging technologies*, yet within the nuclear field, the term refers to a dynamic set of new or rapidly maturing technological capabilities that materially alter how nuclear forces, nuclear-related systems, and their supporting intelligence, space, and cyber infrastructures function.³ These include technologies that change detection, attribution, command and control (C2), survivability, or delivery capabilities of nuclear forces, or that modify decision-making conditions in ways affecting the probability, timing, or character of nuclear use.⁴

Most of these technologies, such as automation, advanced sensing, cyber tools, and enhanced missiles, are evolutionary rather than entirely new inventions, representing advancements of existing capabilities. However, recent developments in their unprecedented scale of deployment, deeper integration into complex systems, increased speed of operation, and enhanced capabilities have fundamentally transformed their strategic significance. Their interaction within complex "system-of-systems" environments can generate new forms of uncertainty, including unpredictable cascading effects or machine-to-machine dynamics that may unfold faster than human operators can manage.⁵

Relevant technologies include advanced AI and machine learning; autonomy and lethal autonomous weapons systems (LAWS); cyber capabilities; hypersonic and other novel delivery systems; improved sensing; Intelligence, Surveillance, and Reconnaissance (ISR) and space systems; advanced guidance-enabled conventional strike systems; directed energy; and emerging convergent fields such as quantum technologies or advanced materials.⁶ Their "emerging" character derives not only from their novelty but from the way they interact with nuclear systems to create new pathways for instability and escalation.

Emerging Technologies and Increased Risks of Nuclear Weapons Use

Emerging technologies complicate the management, credibility, and stability of nuclear arsenals and deterrence strategies. Cyber capabilities, for instance, can compromise early-warning and situational-awareness systems by generating false alarms or eroding confidence in sensors and communication networks.⁷ Such disruptions could precipitate accidental or pre-emptive nuclear responses if a NWS perceives its infrastructure to be under attack.⁸

Emerging technologies, especially those with dual-use capabilities, intensify the 'entanglement' between conventional and nuclear systems. Such ambiguity heightens the risk that conventional actions could be misinterpreted as precursor steps toward nuclear use. This could lead nuclear-armed states to adopt aggressive 'launch-on-warning' doctrines, where missiles are fired upon detection of an incoming attack rather than waiting for confirmation, thereby increasing the chance of accidental war. It also encourages a rapid acceleration of military modernisation, fueling an arms race and significantly raising the potential for miscalculation during crises.⁹

These dynamics blur the line between conventional and nuclear deterrence, narrowing decision-making windows and increasing uncertainty regarding intent and escalation thresholds.¹⁰ These technologies also heighten the risks of misperception and arms racing

3 Kelley M. Saylor, *Emerging Military Technologies: Background and Issues for Congress*, No. R46458. (Washington, DC: Congressional Research Service, 2020), <https://apps.dtic.mil/sti/pdfs/AD1105857.pdf>; Wilfred Wan, Ankit Panda, John Borrie, et al., *Nuclear Risk Reduction: Closing Pathways to Use* (New York: United Nations Institute for Disarmament Research, 2020), <https://doi.org/10.37559/WMD/20/NRR/01>.

4 Mary Chesnut, Tim Ditter, Anya Fink, Larry Lewis, and Tim McDonnell, "Artificial Intelligence in Nuclear Operations," CNA, April 2023, <https://www.cna.org/analyses/2023/04/ai-in-nuclear-operations>.

5 Vincent Boulanin, S.M. Amadae, John Borrie, et al., *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk, Volume I, Euro-Atlantic Perspectives* (Stockholm: Stockholm International Peace Research Institute, 2019), <https://www.sipri.org/publications/2019/research-reports/impact-artificial-intelligence-strategic-stability-and-nuclear-risk-volume-i-euro-atlantic>.

6 Saylor, *Emerging Military Technologies: Background and Issues for Congress*. Op. Cit.

7 Boulanin et al., *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk, Volume I, Euro-Atlantic Perspectives*. Op. Cit.

8 Michael T. Klare, *Assessing the Dangers: Emerging Military Technologies and Nuclear (In)Stability* (Washington, DC: Arms Control Association, 2023), https://www.armscontrol.org/sites/default/files/files/Reports/ACA_Report_EmergingTech_digital.pdf.

9 James Acton, *Silver Bullet? Asking the Right Questions About Conventional Prompt Global Strike*, (Washington DC: Carnegie Endowment for International Peace, September 3, 2013), 75, <https://assets.production.carnegie.fusionary.io/static/files/cpgs.pdf>.

10 *Ibid.*

SECTION 2

Risks and Opportunities Associated with AI

Why Focus on AI?

Among the various emerging technologies, AI deserves particular attention due to its peculiarity, transversality, qualitative differences in risk, and challenges for governance and regulations. First of all, unlike other emerging technologies such as manoeuvrable reentry missiles, cyber attacks, and space technologies, which enhance physical capabilities, AI involves “cognitive and judgmental” processes. In other words, it could directly affect the decision-making of nuclear weapon use. While other technologies bring changes in capability, AI can reshape the judgment and accountability processes. Also, AI has a cross-cutting nature. Rather than operating in a single domain, it serves as an enabling technology that supports intelligence, surveillance, cyber defence, and nuclear command-and-control systems simultaneously.

AI introduces new risks regarding human psychology and cognition through misperception and overreliance on AI. This overreliance can lead to automation bias, where human operators defer excessively to AI recommendations without critical scrutiny. Its ambiguity in algorithms, biases, and adversarial manipulation are novel vulnerabilities that previous technological developments did not introduce. As AI advances to complement human decision-making, human accountability may become increasingly ambiguous. Furthermore, the pace of AI development far exceeds the establishment of ethical, legal, and institutional safeguards. This governance gap makes AI a representative case for understanding how emerging technologies challenge traditional concepts of responsibility and control, necessitating examination of both technical risks and institutional and normative challenges.

As such, AI serves as a paradigmatic case for examining the broad, intersecting challenges posed by technological acceleration, uncertainty, and human responsibility. AI can embody the way cognitive innovation in warfare may shift responsibility from human judgment to opaque systems, reconfigure the foundations of accountability, and force nuclear governance to confront new dilemmas of control and trust.

by enabling more effective counterforce capabilities, creating perceptual vulnerability. This implies a belief that one’s nuclear arsenal is increasingly vulnerable to a disabling first strike, thereby eroding confidence in deterrence and incentivising more pre-emptive or risk-acceptant behaviour during crises.¹¹

The integration of advanced conventional precision-strike systems exacerbates these challenges. Non-nuclear hypersonic weapons, for example, could threaten second-strike assets or perform missions previously reserved for nuclear capabilities. Hypersonic weapons refer not to traditional ballistic missiles, which have long operated at hypersonic speeds, but to newer systems, such as hypersonic glide vehicles and hypersonic cruise missiles, that combine high speed with sustained manoeuvrability and lower-altitude flight profiles.¹² While these systems are not necessarily faster than ballistic missiles, their ability to manoeuvre during flight and operate on less predictable trajectories complicates detection and interception.¹³

If a NWS perceives its retaliatory potential could be neutralised by a rapid counterforce strike, deterrence stability erodes.¹⁴ Because conventional weapons carry a lower perceived threshold for use, these vulnerabilities increase escalation risks; for example, hypersonic weapons can reach targets so quickly that states may lack time to verify impact points or intentions before authorising retaliation, heightening the risk of premature or miscalculated nuclear responses.¹⁵

Finally, AI and machine learning further heighten these concerns, introducing unique challenges related to opacity, transparency, and the compression of decision-making timelines,¹⁶ which will be explored in detail in Section 2. Overall, emerging technologies introduce new failure modes and cascading technical-strategic interactions within nuclear weapons systems and deterrence architectures, making crises harder to manage and increasing the risk of strategic instability and nuclear use.¹⁷

11 Arie Koichi, *Hypersonic Weapons of the U.S., China, and Russia: Implications for Nuclear Deterrence and Arms Control* (Tokyo: National Institute for Defense Studies, 2024), <https://www.nids.mod.go.jp/english/publication/security/pdf/2024/05.pdf>; Oleg Krivolapov, “Redefining Strategic Stability in Post-New START Reality: A Pivotal Role of Missile Defense,” *Stimson Center*, 2023, <https://www.stimson.org/2023/redefining-strategic-stability-in-post-new-start-reality-a-pivotal-role-of-missile-defense/>; Vladislav Chemavskikh and Jules Palayer, *Impact of Military Artificial Intelligence on Nuclear Escalation Risk*, SIPRI Insights on Peace and Security, no. 2025/06 (Stockholm: Stockholm International Peace Research Institute, 2025), https://www.sipri.org/sites/default/files/2025-06/2025_6_ai_and_nuclear_risk.pdf.

12 Stephen Reny, “Nuclear-Armed Hypersonic Weapons and Nuclear Deterrence,” *Strategic Studies Quarterly* 14, no. 4 (2020): 47–73. <https://www.jstor.org/stable/26956152>.

13 *Ibid.*

14 *Ibid.*

15 Koichi, *Hypersonic Weapons of the U.S., China, and Russia: Implications for Nuclear Deterrence and Arms Control*. *Op. Cit.*

16 Chesnut et al., “Artificial Intelligence in Nuclear Operations.” *Op. Cit.*

17 Wan et al., *Nuclear Risk Reduction*. *Op. Cit.*

The Dual-Use Dilemma and the History of AI and Nuclear Weapons

While the potential impacts of AI on nuclear systems are still being assessed, its inherent dual-use nature, coupled with a complex history of application, presents a contentious and evolving challenge to nuclear stability. The “dual-use dilemma” arises when an actor “face[s] an opponent that wields technologies with both civil and military/harmful applications”, resulting in ambiguity around the opposing actor’s intentions.¹⁸ Historically, despite frequent predictions to the contrary, few technological developments have had a transformative impact on nuclear weapons strategy – with the notable exception of intercontinental ballistic missiles (ICBMs) and multiple independently-targetable reentry vehicles (MIRVs).¹⁹

AI has a long history of application to nuclear weapons and strategic systems going back to the Cold War in the Soviet Union, with early work on the potential application of neural networks.²⁰ Since the 1960s, there has been evidence that other states also integrated early forms of AI or AI-like computational systems into nuclear command, control, and communications (NC3) systems, although mostly in the context of data collection and analysis. These early systems, distinct from contemporary advanced AI and large language models (LLMs), laid foundational groundwork for integrating automated processes into strategic decision-making frameworks, albeit with limited autonomy and a strong emphasis on human oversight.²¹ Along with the expansion and development of AI technology through the deep learning revolution of the 2010s, new potential nexuses have emerged between AI and nuclear weapons in NC3 systems, which NWS are primed to explore.²² While the current status of further integration of AI technology into NC3 or nuclear systems more broadly is

unclear, one aspect that is even less clear is how key decision makers view this technology vis-à-vis risk.²³ Understanding how states perceive and evaluate this technology is critical, given its dual-use nature and its salience as a driver of economic growth and military competitiveness.

Multipolarity is adding further complexity. The dynamics of the so-called *Third Nuclear Age*—the emergence of multiple nuclear-armed states alongside rapid technological shifts, particularly with AI—introduce new complexities.²⁴ In this context, technological advancements may have previously unexplored transformative impacts on nuclear weapons strategies as AI introduces new pathways for instability that require proactive management.²⁵

Rather than merely relying on individual decision makers to navigate these complexities, proactive international governance and sustained dialogue are essential to ensure AI’s responsible development and deployment. The transformative potential of AI in the nuclear realm necessitates a deliberate and collaborative approach, as states’ choices today will determine whether this technology amplifies risk or contributes to stability. Our argument posits that without such proactive engagement, the trade-offs between innovation, capability, and risk will likely trend towards increased instability, making the urgent pursuit of dialogue-based solutions paramount.

18 Amir Lupovici, “The Dual-Use Security Dilemma and the Social Construction of Insecurity,” *Contemporary Security Policy*, 42, no. 3 (2021): 257, <https://doi.org/10.1080/13523260.2020.1866845>.

19 Bruno Tertrais, *Real and Imagined Challenges to Strategic Stability* (The Hague: The Hague Centre for Strategic Studies, February 2022), 1, <https://hcss.nl/wp-content/uploads/2022/02/AC2-Real-and-Imagined-Challenges-to-Strategic-Stability-HCSS-2022.pdf>.

20 Oleg Shakirov, “Russian Thinking on AI Integration and Interaction with Nuclear Command and Control, Force Structure, and Decision-Making,” *European Leadership Network*, 2023, 3, <https://europeanleadershipnetwork.org/wp-content/uploads/2023/11/Russian-bibliography.pdf>.

21 Alice Saltini, *AI and Nuclear Command, Control and Communications: P5 Perspectives* (London: European Leadership Network, 2023), <https://europeanleadershipnetwork.org/report/ai-and-nuclear-command-control-and-communications-p5-perspectives/>; Bureau of Arms Control, Deterrence, and Stability, *Political Declaration on Responsible Military Use of Artificial Intelligence and Autonomy* (Washington, DC: United States Department of State, 2024), <https://www.state.gov/bureau-of-arms-control-deterrence-and-stability/political-declaration-on-responsible-military-use-of-artificial-intelligence-and-autonomy>.

22 Paul Scharre, “Debunking the AI Arms Race Theory,” *Texas National Security Review* (2021): 127, <https://tnsr.org/2021/06/debunking-the-ai-arms-race-theory/>.

23 Anna Nadibaidze and Nicolò Miotto, “The Impact of AI on Strategic Stability Is What States Make of It: Comparing US and Russian Discourses,” *Journal for Peace and Nuclear Disarmament* 6 no. 1 (2023): 48, <https://doi.org/10.1080/25751654.2023.2205552>.

24 Andrew Futter and Benjamin Zala, “Strategic Non-Nuclear Weapons and the Onset of a Third Nuclear Age,” *European Journal of International Security* 6, no. 3 (2021): 257–77, <https://doi.org/10.1017/eis.2021.2>.

25 Tertrais, *Real and Imagined Challenges to Strategic Stability*; Saltini, *AI and Nuclear Command, Control and Communications: P5 Perspectives*. *Op. Cit.*

Risks from Ambiguity, Competition, and Secrecy among NWS

Currently, while the full extent of AI integration into the nuclear nexus remains broadly unknown, the potential risks it poses to the existing nuclear non-proliferation architecture appear to outweigh, or are at least not yet matched by, the clearly established positive applications of AI in the nuclear domain, such as signal detection and early warning.

Currently, there is no consensus amongst NWS on what AI entails or the degree of its integration within nuclear weapon systems. Some research highlights that the five nuclear-weapon states (N5) diverge on the meaning of “human-in-the-loop,” creating inconsistent safety expectations and oversight mechanisms.²⁶ The complexity of AI has prompted some NWS, including the United States, to acknowledge the need to achieve and maintain human involvement in the AI-nuclear nexus development.²⁷ This development shows that NWS recognise the risks associated with the complementarity of AI and nuclear weapons systems, particularly those related to miscommunication, misperception, misinterpretation, miscalculation, system failure, deployment, and monitoring inadequacies.²⁸

Any of the aforementioned risks has the potential to enable an unprecedented escalation and potential catastrophe with cascading effects. The lack of clearly defined universal safeguards and governance measures on human oversight complicates how states reconcile these developments with existing legal regimes promoting accountability and risk reduction. International humanitarian law regulates the means and methods of engagement in an armed conflict by armed parties, which are liable to assume responsibility if they violate the law.²⁹ In this regard, the lack of clarity on responsibility in the context of the AI-nuclear nexus insulates operators and decision makers from pertinent legal questions of responsibility and liability, and inadvertently distils the urgency, precision, and weight that generally characterise

the decision-making process for potential nuclear weapons use.

The lack of transparency around the level of AI integration into states’ military and nuclear systems, driven by competition and confidentiality, often leads states to prioritise perceived technological gains over risk mitigation efforts, further heightening uncertainty and undermining trust.³⁰ This competition, fueled by the desire to maintain a perceived technological lead undermines opportunities for dialogue on guard-rails, governance, and regulations due to inherent secrecy. Historical close calls – such as the 1983 Soviet false alarm and the 1995 Norwegian Rocket incident – demonstrate how limited transparency can amplify uncertainty and trigger crisis instability.³¹ Actors aim to compete and outperform adversaries relying on the same technology. The trust and coordination deficit surrounding emerging technologies undermines efforts for a consolidated effort for arms control and risk reduction.³² Therefore, a transparent and participatory framework including NNWS is necessary to mitigate the heightened risks posed by ambiguity and secrecy.

Lastly, while AI-powered technologies for early detection of missile launchers and previously hidden nuclear forces might appear to offer enhanced transparency and situational awareness, they concurrently risk upsetting the understanding of mutual vulnerability by NWS. This means that, regardless of the power of the first strike, the opponents’ ability to retaliate might be perceived as compromised. If the ability to retaliate to a first strike is perceived as compromised, then mutual vulnerability is lost, incentivising an arms race to match or surpass the adversary’s capability.

26 Saltini, *AI and Nuclear Command, Control and Communications: P5 Perspectives*. *Op. Cit.*

27 Greg Torode, “US Official Urges China, Russia to Declare Only Humans, Not AI, Control Nuclear Weapons,” *Reuters*, May 2, 2024, <https://www.reuters.com/world/us-official-urges-china-russia-declare-only-humans-not-ai-control-nuclear-2024-05-02/>; Saltini, *AI and Nuclear Command, Control and Communications: P5 Perspectives*. *Op. Cit.*

28 Su et al., *Advancing Governance at the Nexus of Artificial Intelligence and Nuclear Weapons*. *Op. Cit.*

29 Customary International Humanitarian Law Rule 151, Convention (IV) Respecting the Laws and Customs of War on Land and its Annex: Regulations Concerning the Laws and Customs of War on Land, The Hague, October 18, 1907, art. 50; International Military Tribunal, *Judgment in the Case of The United States of America v. Hermann Wilhelm Göring et al.* (Nuremberg Judgment), vol. 1 (1947); Draft Code of Crimes against the Peace and Security of Mankind with Commentaries (1996), para. 4, 43.

30 Jonathan Kwik and Tom Van Engers, “Algorithmic Fog of War: When Lack of Transparency Violates the Law of Armed Conflict,” *Journal of Future Robot Life* 2, no. (1–2): 43–66. <https://doi.org/10.3233/FRL-200019>; Sofia Romansky, *Lessons from the EU on Confidence-Building Measures Around Artificial Intelligence in the Military Domain* (Stockholm: Stockholm International Peace Research Institute, 2025), 5, https://www.google.com/url?q=https://www.sipri.org/publications/2025/eu-non-proliferation-and-disarmament-papers/lessons-eu-confidence-building-measures-around-artificial-intelligence-military-domain&sa=D&source=docs&ust=1769191095156492&usq=AOvYaw2qDUWRnXluTKtVWj_gx8a-

31 Beyza Unal, Julia Cournoyer, Calum Inverarity, and Yasmin Afina, “Uncertainty and Complexity in Nuclear Decision-Making,” Chatham House, International Affairs Think Tank, 2022, <https://www.chathamhouse.org/2022/03/uncertainty-and-complexity-nuclear-decision-making>.

32 See Paul Scharre and Megan Lamberth, *Artificial Intelligence and Arms Control*, Version 1 (2022), 2, <https://doi.org/10.48550/ARXIV.2211.00065>; See Lionel P. Faitton, “The Impotence of Conventional Arms Control: Why Do International Regimes Fail When They Are Most Needed?” *Contemporary Security Policy* 37 no. 2 (2016): 200–222. <https://doi.org/10.1080/13523260.2016.1187952>; Andrew Kydd, “Arms Races and Arms Control: Modeling the Hawk Perspective,” *American Journal of Political Science* 44 no. 2 (2000): 228, <https://doi.org/10.2307/2669307>; Colin S. Gray, *House of Cards: Why Arms Control Must Fail* (Ithaca, NY: Cornell University Press, 1992).

Opportunities

AI Integration in NC3 and System-Level Benefits

AI has been integrated into nuclear weapons systems covering a range of responsibilities in NC3.³³ Different scholars regard rules-based AI systems as valuable, particularly efficient and reliable in executing well-defined tasks, managing large datasets, enhancing the agility and awareness of operators under extreme conditions, and strengthening access control mechanisms to nuclear systems.³⁴ At present, nuclear weapons operators rely on radar, sonar, and infrared sensor packages in space, on land, and in the ocean that provide timely information, subject to analysis by operators, on whether an adversary has launched a nuclear weapon.³⁵

While some³⁶ attest that AI reduces decision-making time, in fact, through digital twin technologies,³⁷ there is a chance that AI could give operators early detection time to evaluate and implement de-escalation measures before heightened avoidable escalation.³⁸

Generative AI: Dual-Use Nature and Detection Capability

LLMs have been identified as a potential tool to counter proliferation-enabling technologies by enhancing early detection mechanisms, which ulti-

mately reduces the risk of proliferation and potential nuclear weapons use.³⁹

AI-powered technologies empower states to consume and process large datasets in real-time, detecting inconsistencies, anomalies, and enhancing predictive analytics for early warning systems. For instance, generative AI shows promise in increasing the availability and quality of satellite imagery and automating its analysis at nuclear facilities for verification purposes.⁴⁰ Similarly, advanced machine learning tools are increasingly relied upon to analyse seismic data, significantly improving the detection and characterisation of evasive nuclear explosions.⁴¹ Such tools have already been used at the Pacific Northwest National Laboratory to detect unusual patterns indicating diversion from reprocessing facilities⁴² and formal existing verification mechanisms like the International Atomic Energy Agency (IAEA) and the Comprehensive Test Ban Treaty Organisations have begun exploring the possible application of AI in processing nuclear testing and safeguards data.⁴³

The same AI-powered technologies used for verification can also be relied on for precise detection of missile launchers and exposing second-strike capabilities such as nuclear-powered ballistic missile submarines.⁴⁴ Also, machine-learning capabilities in long-range autonomous unmanned aerial vehicles that rely on swarming technologies can provide constant monitoring capability.⁴⁵ In this regard, this technology could significantly improve the timeliness and granularity of assessments of adversaries' second-strike capabilities or may erode the opacity traditionally associated with second-strike forces.

33 Alexa Wehsener, Andrew W.Reddie, Leah Walker, and Philip J. Reiner. 2023. Op.cit; See James M. Action, "Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War," *International Security* 43, no. 1 (2018): 56–99. https://doi.org/10.1162/isec_a_00320.

34 Chernavskikh and Palayer, *Impact of Military Artificial Intelligence on Nuclear Escalation Risk*, 6. Op. Cit.; Herbert Lin, "Artificial Intelligence and Nuclear Weapons: A Commonsense Approach to Understanding Costs and Benefits (Summer 2025)," Preprint, *Texas National Security Review*, 2025, <https://doi.org/10.26153/TSW/60739>.

35 Wehsener, Reddie, Walker, and Reiner, "Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War"; See James M. Action, "Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War," *International Security* 43 no. 1 (2018): 56–99. https://doi.org/10.1162/isec_a_00320.

36 Chernavskikh and Palayer, *Impact of Military Artificial Intelligence on Nuclear Escalation Risk*, 5. Op. Cit.

37 Digital twins technology are, by design, a virtual environment designed around a two-way flow of information that allow policymakers to engage with structured crises scenarios and explore escalation pathways while assisting enhancing efficiency and decision making. See Ganna Pogrebna, Rishi Paul, Nathan Damaj, Jake McNaughton, Graham Stacey, and Immaculate-Motsi Omojiade, "Technological Complexity and Risk Reduction: Using Digital Twins to Navigate Uncertainty in Nuclear Weapons Decision-Making and EDT Landscapes," *European Leadership Network*, 2025, 10, <https://europeanleadershipnetwork.org/policy-brief/technological-complexity-and-risk-reduction-using-digital-twins-to-navigate-uncertainty-in-nuclear-weapons-decision-making-and-edt-landscapes/>.

38 *Ibid.*, 10.; Natasha E. Bajema and John Gower, "Nuclear Decision-Making and Risk Reduction in an Era of Technological Complexity," *Council on Strategic Risks*, December 19, 2022, 195, <https://councilonstrategicrisks.org/wp-content/uploads/2022/12/NuclearTechnologicalComplexity-Dec22.pdf>.

39 David M. Allison and Stephen Herzog, "Artificial Intelligence and Nuclear Weapons Proliferation: The Technological Arms Race for (In) Visibility," *Risk Analysis*, September 25, 2025, [risa.70105](https://doi.org/10.1111/risa.70105), 1-2 <https://doi.org/10.1111/risa.70105>.

40 Jana Balus, "Doomsday Machines? Nukes, Nuclear Verification and Artificial Intelligence," *Armament, Arms Control and Artificial Intelligence: The Janus-Faced Nature of Machine Learning in the Military Realm*, ed. Thomas Reinhold and Niklas Schönig. (Cham: Springer International Publishing, 2022), 111-112, https://doi.org/10.1007/978-3-031-11043-6_8.

41 Anja Kaspersen and Chris King, *Mitigating the Challenges of Nuclear Risk While Ensuring the Benefits of Technology, The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk* (Stockholm: Stockholm International Peace Research Institute, 2019), https://www.jstor.org/stable/resrep24525_20; International Atomic Energy Agency, *Artificial Intelligence for Accelerating Nuclear Applications, Science and Technology*, 1st ed. (Vienna: International Atomic Energy Agency, 2022).

42 Steven Ashby, "How PNNL Is Using Machine Learning To Detect Nuclear Threats Quicker and Easier," *Pacific Northwest National Laboratory*, March 27, 2023, <https://www.pnnl.gov/news-media/how-pnnl-using-machine-learning-detect-nuclear-threats-quicker-and-easier>.

43 Yanliang Pan & Daihan Cheng, "Unleashing AI for Peace: How Large Language Models Can Mitigate WMD Risks," *Arms Control Association*, 2025, <https://www.armscontrol.org/act/2025-04/features/unleashing-ai-peace-how-large-language-models-can-mitigate-wmd-risks#endnote16>.

44 C. G. "Verify, Verify, Verify: How Technological Disruption is Redefining Nuclear Risk," *Stimson Center*, August 5, 2025, <https://www.stimson.org/2025/verify-verify-verify-how-technological-disruption-is-redefining-nuclear-risk/>.

45 Kaspersen and King, "Mitigating the Challenges of Nuclear Risk While Ensuring the Benefits of Technology," 120. Op. Cit.

Responsible Integration of AI: Dialogue as a Foundation & Policy Recommendations

Dialogue as the Foundational Mechanism

Dialogue is a fundamental mechanism for mitigating AI-induced cognitive and judgmental risks. While a mechanism, not a guarantee, dialogue can help to ensure that MHC and “human-in-the-loop” oversight become substantive realities, not merely formalities, by addressing AI’s tendency to exceed human decision-making speed and hide its reasoning in a “black box”.

The nexus between AI and nuclear technology brings about time compression, and millisecond-level processing threatens to bypass human judgment. Historically, dialogue has served as a crucial “intentional pause” that averted catastrophe – for example, during the Cuban missile crisis. In the AI era, this



Dialogue specifically addresses the challenges to human judgment in the following ways:

- 1. Overcoming Automation Bias:** Fostering scepticism about AI limitations, preventing blind trust in its output.
- 2. Reducing Opacity:** Serving as a “translation layer” for states to explain intentions, enabling human interpretation of system behaviour and technical anomalies.
- 3. Addressing Perceptual Vulnerability:** Mitigating misperceptions and replacing mutual suspicion with shared understanding of intentions and capabilities, thereby stabilizing the psychological environment for effective human control.

pause is essential for MHC, allowing leaders to move away from passive “button-pushing” and toward a validated, multi-layered assessment of the crisis.

In order to be rooted in technological reality, effective dialogue requires an epistemic community of scientists, technical experts, and scholars. These experts provide a fact-based foundation for literate discussions, enabling leaders to exercise truly “meaningful” control. Historical precedents, such as the Pugwash Conferences, demonstrate how sustained, informal expert dialogue can foster shared understandings of technological risks, bridging political rhetoric. Epistemic communities also provide policymakers with evidence-based assessments, informing decision-making and supporting governance frameworks grounded in scientific insight and security needs.

Policy Recommendations

To translate this foundational role of dialogue into actionable steps, the international community must adopt concrete policy measures. Given the inherent secrecy surrounding the military applications of emerging technologies and the often slow pace of formal arms control negotiations, these recommendations aim to foster consensus-building, enhance transparency, and cultivate the shared understanding necessary for managing the risks posed by the AI-nuclear nexus. They emphasise a sustained, multi-stakeholder approach to governance, aiming to bridge current trust deficits and mitigate the potential for miscalculation and escalation in an era of rapid technological advancement.

Recommendation 1 (Track 1.5): Build Evidence-Based Frameworks for Responsible Military AI Integration

A priority for Track 1.5 efforts should be the creation of a more systematic approach to assessing the risks of military AI and the development of bridging mechanisms that translate broad, high-level frameworks into regionally and nationally adaptable principles of responsible behaviour. This requires providing governments with robust, evidence-based quantitative, operational, and economic data on the specific ways in which AI may alter nuclear-use risks. Such evidence can serve as the foundation for developing practical and context-sensitive guidelines for responsible integration. Emerging initiatives, such as Responsible AI in the Military Domain (REAIM), already illustrate the value of platforms where governments, military actors, and international organisa-

tions can jointly examine the implications of AI and negotiate shared principles for its responsible use. Track 1.5 mechanisms should expand and institutionalise such dialogues, enabling diverse stakeholders to articulate risks, clarify expectations, and co-design actionable norms that can be meaningfully implemented across different security environments.

Recommendation 2 (Track 1): Reduce Aggregate Nuclear Risk at the Track 1 Level

At the Track 1 level, regulating AI technology faces challenges that complicate risk reduction. The dual-use and digital nature of the technology limits restrictions on technology transfer due to potential downstream economic impacts and difficulties in achieving adequate transparency for state-to-state transfers. If states are to address nuclear risks stemming from AI, that political will may be better matched with the pathways provided by the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) or the Treaty on the Prohibition of Nuclear Weapons (TPNW), which directly address nuclear risk by targeting the underlying cause: nuclear weapons.

A constructive and viable approach in reducing nuclear risk is to utilise the existing NPT framework at the Review Conference to obtain an agreement to address the risks posed by AI in the form of a consensus document with an action plan.

This would raise awareness and build understanding of AI-associated risks, address nuclear risks more broadly, and demonstrate the member states' continued unified commitment to nuclear disarmament.

Recommendation 3 (Track 2): Establish an Independent Advisory Committee

At the Track 2 level, the UN (United Nations) could establish an Independent Advisory Committee on Emerging Technologies and Nuclear Weapons Risks under the auspices of the United Nations Office for Disarmament Affairs (UNODA). Drawing inspiration from the advisory mechanisms of the IAEA, this committee would operate as a separate and independent body, ensuring that technical expertise and

non-state perspectives are systematically integrated into nuclear governance debates to cooperate with the dual nature of emerging and disruptive technologies (EDTs), reduce secrecy and ambiguity, and enhance transparency.

Unlike existing models such as the Organisation for the Prohibition of Chemical Weapons (OPCW) Scientific Advisory Board, even for state-level-run organisations, committee members should not be nominated by the government but nominated and selected through recommendations from international scientific associations, professional societies, and research networks, thereby safeguarding independence, diversity, and expertise. Membership should be periodically reviewed and regionally balanced to avoid political or corporate capture. Operating under the Chatham House Rule, the committee would provide a neutral platform for frank exchanges. Its consolidated findings, including annual technical assessments, best-practice guidelines, and proposals for transparency measures, would be submitted to state-led negotiations convened by UNODA. UNODA should formally circulate the committee's proposals to state delegations and invite responses, ensuring that its recommendations feed into the official agenda-setting process, thus granting an indirect but meaningful voice to non-state stakeholders and enhancing transparency.

Recommendation 4: Advance Inclusive and Innovative Diplomacy

Considering NNWS have the right to actively participate in discussions that have bearing on their national security, NWS should ensure the presence of NNWS in the arms control and risk reduction dialogue.⁴⁶ Specifically, NNWS within the Stockholm Initiative for Nuclear Disarmament⁴⁷ have already demonstrated an interest in addressing emerging technologies and their relationship to the NPT's three pillars, producing a NPT PrepCom 2024 working

⁴⁶ See United Nations, General Assembly, *Final Document of the Tenth Special Session*, Resolution S-10/2, June 30, 1978, A/S-10/4. There has been limited engagement with NNWS from developing countries on these key nuclear issues due to their perceived capacity limitations and development deficit. Instead of being at the periphery of the dialogue based on a capacity deficit, NNWS have consistently, within the NPT, indicated legitimate interests to further risk reduction measures by understanding the operational status of nuclear weapons systems in a way that promotes international stability and peace, and to vocalize their fears of the emerging technology integration in weapon systems.

⁴⁷ Paul Ingram. *The Stepping Stones Approach to Nuclear Disarmament Diplomacy*. BASIC, 2021. <https://basicint.org/wp-content/uploads/2021/12/The-Stepping-Stones-Approach-to-Nuclear-Disarmament-Diplomacy.pdf>.

paper on this topic.⁴⁸ This demonstrates the value of NNWS, as norm entrepreneurs who can share insights from the lived experiences of nuclear legacies, and add humanitarian nuance often missing in these discussions. Furthermore, recognising that technological innovation often outpaces regulation, states should extend invitations to the private sector, which drives competition and investment in emerging technologies.⁴⁹ Through Track 2 initiatives, the private sector can engage in open dialogue and observe meetings on the emerging tech-nuclear nexus. Neutral venues like the United Nations Institute for Disarmament Research (UNIDIR) can host informal, meaningful engagements for the private sector, think tanks, academia, and policymakers, akin to the United States-Russia Cyber-Nuclear Weapons Dialogue.⁵⁰ These Track 2 dialogues foster mutual understanding and voluntary participation, circumventing legal or political expectations that often hinder candid state engagement. Ultimately, this process aims to build towards the establishment of formal engagements and commitments.

Recommendation 5 (Track 2): Democratise Risk Literacy through “Gamified Crisis Simulations”

To bridge the gap between technical complexity and public understanding, academic and technical communities should collaborate to develop open-source “Gamified Crisis Simulations.” This would catalyse inclusive dialogue, making abstract risks like “entanglement” and “time compression” more accessible to the public. By simulating these pressures, such games would provide a shared experience that transcends jargon, enabling more meaningful dialogue between citizens and experts on the necessity of human oversight and potential escalation pathways involving AI.

This would allow people to experience potential escalation and de-escalation nuclear use scenarios involving AI (and potentially other EDTs as well). Last but not least, these platforms would act as a mechanism for data collection. By analysing anonymous user data regarding when and why participants defer to AI during simulated crises, experts can empirically track patterns of “automation bias.” This feedback loop creates a technical dialogue between users and developers, ensuring that future human-machine interfaces are designed based on actual human cognitive behaviours rather than theoretical assumptions.

48 See Working paper submitted by the members of the Stockholm Initiative for Nuclear Disarmament (Argentina, Canada, Ethiopia, Finland, Germany, Japan, Jordan, Kazakhstan, Netherlands (Kingdom of the), Norway, Republic of Korea, Spain, Sweden and Switzerland) NPT/CONF.2026/PC.III/WP.35, “Navigating the potential impact of emerging technologies on nuclear disarmament, arms control, non-proliferation and peaceful uses of nuclear energy and technology.”

49 Justin Krauss, “Tapping the United States’ Greatest Weapon: innovation” *J.P. Morgan Insights*, September 18, 2025, <https://www.jpmorgan.com/insights/business-planning/defense-tech-innovation-and-the-role-of-startups>; Dale Swartz and Ryan Brukart, “Creating a Modernized Defense Technology Frontier,” *McKinsey and Company*, February 2025, <https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/creating-a-modernized-defense-technology-frontier>.

50 Page Stoutland, “U.S.-Russia Cyber-Nuclear Weapons Dialogue.” The Nuclear Threat Initiative, accessed November 30, 2025, <https://www.nti.org/about/programs-projects/project/u-s-russia-cyber-nuclear-weapons-dialogue/>.

Conclusion

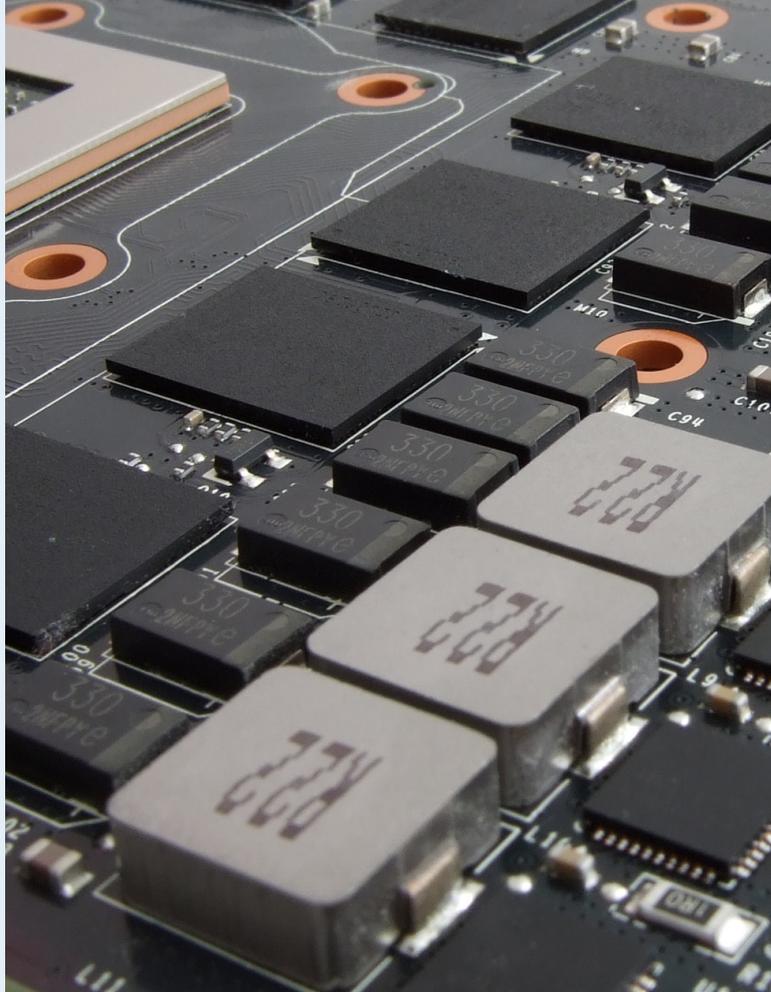
This paper has examined how emerging technologies, including AI, transform nuclear risks as they become integrated into nuclear weapons systems, and how we should manage these changes.

Firstly, the rise of emerging technologies is transforming the nuclear weapons debate from one focused on conventional physical destructive power to the “cognitive” domain of command and control and decision-making. While AI and autonomous systems dramatically increase the speed of the decision-making process, they bring ambiguity in the ownership of responsibility and destabilise nuclear governance, where the fusion of machine speed and human judgment has the potential to create new sources of instability. This is a paradigm shift that demands that both NWS and NNWS reexamine the premises of their security.

Secondly, this transformation possesses a dual nature of “risk” and “opportunity.” On the risk side, the danger of misidentification due to algorithmic opacity and the risk of escalation from the “entanglement” of conventional weapons and nuclear systems are increasing. However, the technological opportunities must not be overlooked. Ensuring redundancy in AI-powered early warning systems and enhancing verification capabilities through satellite image analysis can become powerful tools for increasing transparency in the non-proliferation regime and preventing miscalculations. What is crucial is governance that maximises these opportunities while controlling the risks.

Thirdly, to address this challenge, this report proposed multi-layered policy recommendations centered on fostering inclusive dialogue, enhancing transparency, and strengthening governance mechanisms across various stakeholders to ensure responsible AI integration and reduce nuclear risks. These measures do not function in isolation; they form a comprehensive approach that only becomes effective when mutually reinforced.

A key challenge moving forward is how to adapt and implement these recommendations in the face of rapid technological progress. Particular attention must be paid to maintaining the balance required



for technological regulations to function as security guardrails without stifling private-sector innovation. This necessitates the development of agile governance models capable of keeping pace with the speed of technological evolution.

Ultimately, in the current international context marked by deepening divisions and distrust, concluding a comprehensive treaty immediately may prove difficult. Yet precisely because of this situation, the practical approaches toward “institutionalising continuous dialogue” and “ensuring transparency” demonstrated in this study hold significant value.

Whether technology becomes a catalyst for catastrophe or a foundation for stability depends on the dialogue we choose and the responsible actions we take now. We hope the proposals in this paper will constitute a solid step towards reducing nuclear risk in an uncertain era.



WORKING GROUP 2

The Role of Kataribe Oral Storytelling in a Post-Hibakusha Nagasaki

GROUP MEMBERS:

Franco Castro Escobar
Yerdaulet Rakhmatulla
Hazel Ropafadzo Ruzani
Nina VanderVeen
Kazushi Akizuki

Introduction

The memorialisation of Nagasaki's experience of a nuclear bombing (hereafter 'Nagasaki's experience') faces at least three key challenges: to avoid forgetting, misremembering, and aimless commemoration.

Thinking about how best to educate the general public on Nagasaki's experience, and how future generations can meaningfully commemorate the lives and memories of atomic bomb survivors (*Hibakusha*, in Japanese), this paper focuses on the following research question: *How can the oral tradition of Kataribe storytelling make Nagasaki's experience a more enduring memory in a post-Hibakusha world?*

This paper begins by first reviewing the broader literature on oral storytelling traditions with a narrower focus on the concept of *Kataribe*.

Second, it discusses the strengths and limitations of Kataribe storytelling in relation to the three key challenges outlined. While none of these challenges are entirely new, debates around them will likely widen as the population of Japanese Hibakusha – estimated at 99,130 as of March 2025⁵¹ – continues to decline as we approach a “post-Hibakusha World”.⁵² Third, it concludes that, in a world without atomic bomb survivors, Kataribe's key strength lies in the retention of human agency in processes that make cultural information psychologically appealing, relatable, and meaningful over time. This strength is evident in memorial practices that replicate Hibakusha's act of disaster oral storytelling in dynamic, diverse, and digitally-enabled cultural environments.

SECTION 1

Oral Traditions: Passing Down Information

According to Richard Dawkins, who coined the term *meme* in 1976, the transmission of units of cultural information is analogous to biological gene transmission.⁵³ He argued that stories and ideas are kept alive in dynamic cultural environments when human brains are turned into propagating vehicles that replicate them. For him, ideas survive time when their properties become psychologically appealing, socially valuable, or otherwise tied to other appealing ideas, regardless of their historical accuracy. Illustrating his argument, Dawkins noted that the idea of 'God' is tied to appealing stories about 'hell', the concept of 'faith', as well as deep and troubling questions about human life.⁵⁴ As ideas leap from brain to brain in a process of imitation, some original features may be retained, and others lost, modified, or blended. Therefore, memes are units of cultural information that are passed down, but vary in longevity (their temporal life span), fecundity (their psychological appeal), and copying fidelity (the accuracy of replication based on the original structures/properties).⁵⁵

While Dawkins' meme theory remains contested,⁵⁶ research on narratology generally agrees that oral traditions of storytelling render information culturally relevant and memorable primarily through human agency.⁵⁷ While orally transmitted stories benefit from having salient narrative features (e.g. bizarre or outlandish qualities, like mermaids and cyclops) or rhymes and rhythm in their structure (e.g. like in poetry), their key strength lies in the presence of storytellers whose human agency enables stories to become relatable, meaningful, and emotional through a “regular practice of continual repetition of reading

53 Richard Dawkins, *The Selfish Gene* (Oxford: Oxford University Press, 1989).

54 Dawkins described that while we ignore the origin of the idea of 'God', it continues to be replicated by spoken and written words, consistently aided by music and art, and that it has mutated or been blended with other ideas. Other culturally enduring stories and ideas include those relating to Kings, Socrates, Da Vinci, Copernicus, among others.

55 Dawkins, *The Selfish Gene*. *Op. Cit.*

56 Kate Distin, *The Selfish Meme: a Critical Reassessment* (Cambridge: Cambridge University Press, 2005); Gregory Schrempf, “Taking the Dawkins Challenge, or, the Dark Side of the Meme,” *Journal of Folklore Research* 46, no. 1 (2009): 91–100, <https://www.jstor.org/stable/40206941>; Nick Rose, “Controversies in Meme Theory,” *Journal of Memetics-Evolutionary Models of Information Transmission* 2, no. 1 (1998): 43.

57 Jack Zipes, “What Makes a Repulsive Frog So Appealing: Memetics and Fairy Tales,” *Journal of Folklore Research* (2008): 109–143.

51 Japan's Ministry of Health, Labor, and Welfare, 被爆者数-平均年齢 [Number of Atomic Bomb Survivors and Average Age], accessed September 23, 2025, https://www.mhlw.go.jp/stf/newpage_26531.html.

52 Katharine Starr, “Atomic Anniversaries: Mediated Memories of Hiroshima and Nagasaki in a Post-Hibakusha World” (2022).

The Kataribe Concept

and recitation”.⁵⁸ According to Crowley, the long lifespan of some modern religions is largely due to how their oral traditions embed “extraordinary events, characters, and deliberate recitation of scripture” into the public consciousness. This occurs despite modern secularisation in many nations.⁵⁹

Oral storytelling is a form of bidirectional verbal communication and has the unique potential to link performers and audience in a process of speaker-listener neural coupling.

This activates mirror neurons and makes the performers uniquely good vehicles for empathy.⁶⁰ In addition, Drout notes that oral traditions pass down not just narrative elements, but also the act of storytelling itself: “When one person imitates a behaviour of another, a meme has managed to replicate itself by being copied from one human mind to another”.⁶¹ Among several limitations, oral storytelling has shorter longevity than written stories. This is because oral stories last as long as the narrator’s voice is audible, unless the audio is recorded and preserved for posterity or replicated by other performers.⁶² Oral storytelling may sacrifice copying fidelity due to the imperfections of human memory.⁶³

The specific longevity, fecundity, and copying fidelity of oral traditions may vary on a case-by-case basis. Oral traditions tend to be stronger at making stories more psychologically appealing, relatable, and meaningful through a process led by human agency.

The *Kataribe* concept derives from the Japanese 語り部 (‘storyteller’ in English). It traditionally referred to a hereditary role of narrators in the Early Imperial Japanese Court in relation to both the storyteller as a performer and the act of storytelling.⁶⁴ More recently, the title has been given to “disaster storytellers” such as survivors of war, descendants of war victims, or survivors of natural disasters (e.g. earthquakes and tsunamis), among others.⁶⁵

In the context of nuclear weapons, *Kataribe* is “a title given to witnesses of the atomic bombing in Japan with authority born of direct experience to tell their stories.”⁶⁶ The Nagasaki City Heritage Division defines *Kataribe* as “storytellers who recount their personal atomic bomb experiences to younger generations, in the strong hope that there will never again be A-bomb victims, and that all nuclear weapons will be eliminated from the Earth”.⁶⁷ In Nagasaki, *Kataribe* are understood as witnesses of the atomic bomb and typically aim to pass down stories and hopes to future generations through storytelling activities that take three common forms: (a) lecture-based, (b) interactive discussions, such as circles or less public formats, or (c) experiential, such as guided visits to war sites, museums, monuments, or ruins.⁶⁸

While direct experience is an important element of A-bomb *Kataribe* storytellers in Nagasaki, in the context of the 2011 nuclear accident at the Fukushima Daiichi Nuclear Power Plant it is notable that, “[n]o qualifications are needed to become a *kataribe* . . . Anyone who has registered with an associated foundation can share their stories as

58 Kevin A. Crowley, “Memorability in Narration: An Overview of Mnemonic Features in Oral and Written Tradition,” *Kalby Studijos* 32 (2018): 85.

59 *Ibid.*

60 Greg J. Stephens, Lauren J. Silbert, and Uri Hasson, “Speaker–Listener Neural Coupling Underlies Successful Communication,” *Proceedings of the National Academy of Sciences* 107, no. 32 (2010): 14425–14430.

61 Michael DC Drout, “A Meme-Based Approach to Oral Traditional Theory,” *Oral Tradition* 21, no. 2 (2006): 270.

62 The first oral history project using tape-recorders reportedly began in 1948. See, Yow, Valerie Raleigh. *Recording oral history: A guide for the humanities and social sciences*. Bloomsbury Publishing PLC, 2014.

63 Daniel L. Schacter, “The Seven Sins of Memory: Insights from Psychology and Cognitive Neuroscience.” *American Psychologist* 54, no. 3 (1999): 182.

64 Flavia Fulco, “Kataribe: A Keyword to Recovery.” *Practice of Storytelling in Post-Disaster Japan, Japan Insights* (2017): 1–28.

65 Millie Creighton, “A View from Japan’s and Tohoku’s 2011 Disasters’ 10th Anniversary: Past, Present, Future,” *Japan Anthropology Workshop* online series of Reflections from Tohoku; Flavia, Fulco. “Kataribe: Ten Years of Post-Disaster Storytelling in Tohoku.” *JAWS Online Series of Reflection on Tohoku*, January 18, 2022, <https://japananthropologyworkshop.org/kataribe-ten-years-of-post-disaster-storytelling-in-tohoku/>.

66 Gwyn McClelland, *Dangerous Memory in Nagasaki: Prayers, Protests and Catholic Survivor Narratives*. (London: Routledge, 2019), 19.

67 See, “Nagasaki Peace- Search for Survivors,” Nagasaki Peace, accessed November 6, 2025, <https://nagasakipeace.jp/en/search/survivors/>.

68 Julia Gerster et al., “Whose Lessons Do We Learn? On the Absence of Women’s Memory in Public 3.11 Disaster Memorial museums in Japan,” accessed October 16, 2025, <http://dx.doi.org/10.2139/ssrn.5413199>; Japan’s Ministry of Health, Labour and Welfare, 平和の語り部事業について | 厚生労働省 [About the Piece Storytelling Process], accessed October 16, 2025, https://www.mhlw.go.jp/stf/newpage_57367.html.

Post-Hibakusha Oral Storytellers

In 2014, responding to the declining population of Hibakusha, Nagasaki began training oral storytellers who lack direct experience of nuclear harm but can emulate Hibakusha's act of witness testimony storytelling (in Japanese, *Shogensha*).⁷⁴ One training programme is called *Certified A-bomb Legacy Successors* (in Japanese, *Densho-sha*),⁷⁵ and it extends to "people other than family" who can become Legacy Successors after completing official training.⁷⁶ In addition, considering the psychological appeal and social value placed on hereditary lines, a second program specifically trains Hibakusha's relatives and descendants as oral storytellers. This second programme is called *Certified A-bomb Family Legacy Successors* (in Japanese, *Kazoku-densho-sha*). Both programmes take around three years to complete, requiring trainees to listen to Hibakusha's testimonies, refine public speaking skills, and produce narrative materials such as scripts, images, and PowerPoint slides. After training, individuals receive official certification by government authorities and can then be commissioned for storytelling sessions emulating Hibakusha's original testimonies of nuclear harm.⁷⁷

Both *densho-sha* and *kazoku-densho-sha* are trained to focus on the 1945 A-bomb experience, but ignore postwar experiences such as subsequent poverty, discrimination, or ongoing radiation-related health effects.⁷⁸ Despite a stringent emphasis on historical facticity, "a small number of rogue legacy successors" have been found to stray from their training by embellishing, altering, and making up stories, prompting governmental authorities to introduce a monitoring scheme that evaluates the storyteller's performance to protect trust in the programmes.⁷⁹

kataribe".⁶⁹ Even as the boundaries of who can serve as Kataribe remain fluid and contested across time and place, with direct experience neither universally nor consistently required, Ogawa highlights one key distinctive trait in Kataribe storytelling: the act transcends factual transmission by engaging with the transmission of emotions, the articulation of lessons learned, and the production of empathy.⁷⁰ To illustrate this, although Kataribe take their audiences to disaster locations, they differ from tourist guides in that their emphasis is on conveying personally and communally felt emotions, not just historical facts.⁷¹

For some scholars, the presence of Kataribe storytellers is "necessary for sustainable and effective disaster management".⁷² More broadly, since 'memory' can be defined as a practice, "embodied and performed in interaction between individual and group, or self and society,"⁷³

Kataribe can be understood as human vehicles of disaster memory who embody and perform cultural information, emotions, and meaning linked to disasters via oral storytelling.

69 Hitomi Matsunaga et al., "What Characteristics Define Individuals Who Serve as Kataribe (Storytellers) in Conveying Lessons Derived from the Unprecedented Nuclear Disaster at the Fukushima Daiichi Nuclear Power Plant?" *Frontiers in Communication* 10 (2025): 2.

70 Akiko Ogawa, "Kataribe Storytellers: How Can Firsthand Experiences of War and Disaster be Passed on to Future Generations?" in *Impacts of Museums on Global Communication*, 157-176 (Hershey, PA: IGI Global, 2025).

71 Japan Anthropology Workshop, "Kataribe: Ten years of post-disaster storytelling in Tōhoku, by Flavia Fulco," accessed November 19, 2025, <https://japananthropologyworkshop.org/kataribe-ten-years-of-post-disaster-storytelling-in-tohoku/>; Kasi L. Smart, "Storying a Disaster: A Podcast," (PhD dissertation, University of Wyoming, 2025), ProQuest (32236250) <https://www.proquest.com/dissertations-theses/storying-disaster-podcast/docview/3241715208/se-2>.

72 Shosuke Sato and Masahiro Iwasaki, "Learning from the Training for the Successors and Storytellers the Legacy of Atomic Bombing in Hiroshima City: Lessons for Disaster Storytellers," *Journal of Disaster Research* 16, no. 2 (2021): 216.; See also: Shingo Nagamatsu, Yoshinobu Fukasawa, and Ikuo Kobayashi, "Why Does Disaster Storytelling Matter for a Resilient Society?," *Journal of Disaster Research* 16, no. 2 (2021): 127-134.

73 McClelland, *Dangerous Memory in Nagasaki: Prayers, Protests and Catholic Survivor Narratives*, 11. Op. Cit.

74 Both 'witnesses' (*Shogensha*) and 'storytellers' (*Kataribe*) are seen as 'custodians of memory' who "attempt to critically intervene in given cultural and social contexts" through their oral narratives. Generally, the key difference is direct experience and intention. See: Lisa Yoneyama, *Hiroshima Traces: Time, Space, and the Dialectics of Memory*, vol. 10. (Berkeley: University of California Press, 1999): 42, 83.

75 The 'Legacy Successors' programme was first launched two years earlier in Hiroshima, in 2012.

76 Shosuke Sato and Masahiro Iwasaki, "Learning from the Training for the Successors and Storytellers the Legacy of Atomic Bombing in Hiroshima City: Lessons for Disaster Storytellers," *Journal of Disaster Research* 16, no. 2 (2021): 216.

77 *Ibid.*

78 Luli van der Does and Andrew Hoskins, "Fall of Living Memory: Forgetting the Atomic Bombings of Japan," *The RUSI Journal* 170, no. 5 (2025): 35, <https://www.tandfonline.com/doi/full/10.1080/03071847.2025.2570565>.

79 *Ibid.*, 35.

At the time of writing, there are 239 certified *Densho-sha*, and 39 *Kazoku-densho-sha*. While both kinds of Legacy Successors engage in a kind of disaster storytelling, what makes Kataribe distinct is that they “can exercise artistic license to amplify or modify the original.”⁸⁰

In Nagasaki, the youngest Kataribe, Soshi Hosoi, began storytelling activities at the age of ten, conveying the experiences of 83-year-old Nagasaki A-bomb survivor Shizuko Mitamura. Despite lacking direct experience of nuclear harm, his activities take the role and spirit of Kataribe in the act of storytelling.⁸¹ When disaster storytellers lack direct experience, they engage in what scholars call “prosthetic memory”, understood as creating “a personal, deeply felt memory of a past event through which [a viewer] did not live”.⁸² Hosoi uses slides and paper theatre to make his stories accessible.⁸³ When addressing young audiences, Hosoi avoids the technical term *radioactive fallout* and uses analogies such as “dust from the atomic bomb that spread through the air”. Supported by his family, Hosoi prepares and adjusts 30-minute talks, occasionally changing his delivery (rhythm, speed, wording, and other characteristics) to make the story easier to understand, clear, appealing, and relatable.

Existing literature has yet to address how Kataribe – either as the performers or the act of oral storytelling – may help address key challenges regarding the memory of Nagasaki’s experience in a post-Hibakusha world.

SECTION 4

The Strengths and Limitations of Kataribe Storytelling in Relation to the Three Key Challenges

Challenge One: Forgetting Nagasaki

Given the dwindling population of Hibakusha and current sociopolitical trends, how likely is Nagasaki’s experience to be forgotten in a post-Hibakusha world? According to recent surveys, in the United States (U.S.), 54% of adults self-report knowing “a little”, 29% – “a lot”, and 16% – “nothing at all” about the use of nuclear weapons against Nagasaki and Hiroshima. Notably, Americans aged under 30 are more likely to believe the use of nuclear weapons in 1945 was “not justified”, indicating that attitudes regarding Nagasaki’s experience can change across generations.⁸⁴ In Europe, rather than ignorance or forgetfulness, over 70% of one survey’s respondents show widespread feelings of powerlessness regarding nuclear policies, indicating that while citizens have some knowledge and care about nuclear issues, they feel unable to affect political outcomes.⁸⁵ The public’s knowledge, attitudes, and emotions regarding nuclear weapons matters because public opinion can both enable and constrain elite decision-making over certain nuclear policies.⁸⁶ In Japan, only 25.6% of people nationwide can accurately date Nagasaki’s atomic bombing (not significantly different from Hiroshima’s 29.5%).⁸⁷ While this figure may not seem worryingly low, it stands in stark contrast to the nation’s history and commemorative practices.

80 *Ibid.*, 35.

81 NHK, 2025年 戦後80年「戦争をなくしたい」83歳の被爆者と10歳の少年の「約束」 [2025: 80 Years After the War: “We Want to End War” - A Promise Between an 83-Year-Old A-Bomb Survivor and a 10-Year-Old Boy]. NHK World-Japan video, 2025, <https://news.web.nhk/shutoken/articles/101/021/85/>.

82 Alison Landsberg, *Prosthetic Memory: the Transformation of American Remembrance in the Age of Mass Culture* (New York: Columbia University Press, 2004).

83 Takashi Ogawa, 小学4年の「語り部」デビュー、長崎で被爆した83歳の体験受け継ぐ [長崎県] [戦後80年 被爆80年]: 朝日新聞 [Debut as a Storyteller in 4th grade, Inheriting the Experiences of an 83-year-old Nagasaki Atomic Bomb Survivor]. *Asahi Shimbun*, 2025, <https://www.asahi.com/articles/AST3Q3CY3T3QTOLBoo9M-html?msocid=1152bd7cb77867e60fb1a927b6cf66a7>.

84 Emma Kikuchi, “80 Years Later, Americans Have Mixed Views on Whether Use of Atomic Bombs on Hiroshima, Nagasaki was Justified,” *Pew Research Centre*, 2025.

85 Benoit Pelopidas, “The Next Generation(S) Of Europeans Facing Nuclear Weapons: Forgetful, Indifferent, But Supportive?” *EU Non-Proliferation Consortium Non-Proliferation Papers* (2017), 7 <https://www.sipri.org/sites/default/files/The-next-generation%28s%29-Europeans-facing-nuclear-weapons.pdf>; Benoit Pelopidas and Fabricio M. Fialho, “Nagasaki’s shadows: European citizens facing nuclear weapons,” *The Conversation*, 2019.

86 Michal Smetana et al., “Atomic Responsiveness: How Public Opinion Shapes Elite Beliefs and Preferences on Nuclear Weapon Use,” *European Journal of International Security* (2025):1–21, <https://doi.org/10.1017/eis.2025.10031>.

87 Miki Masaki, “Seventy Years Later: Perpetuating Memory as Recollections of the Atomic Bombings Fade,” NHK Broadcasting Culture Research Institute, accessed October 16, 2025, <https://www.nhk.or.jp/bunken/d/en/research/yoron/BUNA0000110650110001/>; In 2025, NHK conducted another survey finding that 75.0% of the population nationwide could accurately date the atomic bombings. However, changes in the methodology allowing respondents to take the questionnaire home and answer asynchronously may have produced changes in the results if respondents searched for answers online. See, https://www.nhk.or.jp/bunken/research/yoron/pdf/20250828_2.pdf.

Official Commemoration

Official ceremonies function as authoritative spaces of memory transmission. They are among the few institutional spaces where Hibakusha testimonies have been ritualised and repeatedly reproduced over decades. Every 9 August, Nagasaki commemorates the victims of the atomic bombing at exactly 11:02 am, the moment when the bomb exploded in 1945. Official commemorative ceremonies take place annually, replicating established practices of oral remembrance long-shaped by Hibakusha's testimonies and drawing yearly audiences nationally and internationally, however modest in size. In 2025, approximately 2,700 attendees from 95 countries participated in Nagasaki's official Peace Ceremony. This figure is remarkably smaller compared to Hiroshima's 55,000 attendees from 120 countries.⁸⁸ People without invitation can follow the official ceremony via television broadcasts and online livestreams, which have become increasingly important in reaching audiences both within and outside Japan. The 2025 YouTube live broadcast of Nagasaki's ceremony has been viewed by 16,615 people, which is more than twice the number of viewers for Hiroshima's ceremony.⁸⁹

Since 2000, Nagasaki's ceremony has featured two children's choirs. One from Shiroyama Elementary School singing "Korano-mitamayo" (meaning, "children's precious life") and one by Yamazato Elementary School singing "Anoko" (meaning "that girl"), alternating each year. In 2025, both schools performed jointly for the first time, singing "Kusunoki" (meaning "camphor trees"), a modern song by Nagasaki-born singer Masaharu Fukuyama inspired by the 500-year-old camphor tree which survived the atomic bomb at about 800 meters from the hypocenter at Sanno shrine. This change reflects how certain features in remembrance practices become more salient as ideas and symbols are tied to cultural practices. In this case, the idea of *hibaku-jumoku* (meaning "A-bomb survivor trees") is tied to the tra-

ditional children's choirs of Nagasaki's commemorative ceremonies.

There are approximately 50 *hibaku-jumoku* in Nagasaki.⁹⁰ While survivor trees offer non-verbal testimony (bearing the scars from the atomic bombs on their trunks and branches),⁹¹ their cultural meaning requires human interpretation, which Kataribe storytellers can help provide. In disaster sites, survivor trees are often provided with memorial functions by being adorned as urban monuments with plaques and labels, and cared for by schoolchildren,⁹² treated as living (yet wordless) witnesses of nuclear harm,⁹³ and valued for their ability to create "sticky" or "resonant" affective bonds with communities.⁹⁴ In a post-Hibakusha world, Kataribe may supplement narratives from official commemorative ceremonies, using trees as disaster sites.

Official commemorative ceremonies grant some legitimacy and durability to the memory of Nagasaki's experience, but also shape what is publicly recognised as Nagasaki's past, what lessons are officially endorsed, and which symbols (children, peace, survivor trees) become canonical and are carried forward nationally and internationally. In a post-Hibakusha world, official ceremonies will continue to display some elements of Nagasaki's experiences that have been preserved, simplified, or transformed to remain transmissible to younger and international audiences.

According to meme-theory, what Kataribe storytelling is best positioned to pass down is the psychological appeal (fecundity) of stories based on Nagasaki's experience. Given that affective resonance may be as important as (if not more than) historical facticity for long-term cultural transmission, Kataribe can help anchor stories that may otherwise erode in official commemorative ceremonies, such as Hibakusha's post-war experiences. This does not imply that Kataribe should deviate from the truth but that

88 Nagasaki Shimbun, 長崎原爆きょう 80年 95カ国・地域など2700人が式典参列へ [80 Years Since the Nagasaki Atomic Bombing: 2,700 Participants from 95 Countries and Regions to Attend the Peace Ceremony] Youtube video, August 9, 2025 <https://www.nagasaki-np.co.jp/kijis/?kijid=bcbf1aa72c7940bca03e3d94d956ecd5>; According to the Prime Minister's Office of Japan, Hiroshima's Peace Ceremony was attended by 55,000 participants from 120 nations. See: <https://japan.kantei.go.jp/103/actions/202508/06hiroshima.html> (accessed 27 November 2025).

89 ANN/TV Asahi, ライブ】80回目の原爆の日 広島平和記念式典【LIVE】(2025年8月6日) ANN/テレ朝 [80th Anniversary of the Atomic Bombing: Hiroshima Peace Memorial Ceremony (Live)] Youtube video, August 6, 2025, <https://www.youtube.com/watch?v=gOtcYhxRC8>; ANN/TV Asahi, 【ライブ】80回目の原爆の日 広島平和記念式典【LIVE】(2025年8月6日) ANN/テレ朝 [80th Year Since the Atomic Bombing: Nagasaki Atomic Bomb Victims Memorial and Peace Prayer Ceremony].- Youtube video, August 9, 2025, <https://www.youtube.com/watch?v=cNPlzNcC-Ek>.

90 Masaharu Fukuyama, "The Nagasaki Kusunoki Project," accessed September 23, 2025, <https://nagasaki.kusunoki-project.jp/page/en/>.

91 Takayo Negishi and Hirotsugu Kanno, "Earthquake and War-Damaged Trees in Urban History: Non-Destructive Tree Diagnosis Using Sonic Tomography," *Land* 12, no. 10 (2023): 1931; N. Owaki, et al., "Abnormal Tree Form of A-bombed Trees in Hiroshima," *Journal of the Japanese Institute of Landscape Architecture* 77 (2014): 627-632; N. Owaki, M. Suzuki, and K. Ohbi, "Conservation of Undiscovered A-Bombed Trees in Nagasaki," *Landscape Research Japan* 79, no. 5 (2016).

92 Alois Riegl, "The Modern Cult of Monuments: Its Character and Its Origin," trans. Kurt W. Forster and Diane Ghirardo, *Oppositions* no. 25 (1982): 21-51.

93 Robert Jacobs, "Not Seeing the Contaminated Forest for the Decontaminated Trees in Fukushima," *Asia-Pacific Journal* 19, no. 17 (2021): e5, <https://apjif.org/2021/17/jacobs>; Jon L. Pitt, "Documenting Wordless Testimony: Botanical Witnesses of Hiroshima and Chernobyl," *Angelaki* 28, no. 4 (2023): 61-75, <https://www.tandfonline.com/doi/abs/10.1080/0969725X.2023.2233801>.

94 Jacky Bowring, "Survivor trees: Spectrality and stickiness," *Fabrications* 29, no. 1 (2019): 21-36.

they can mobilise their artistic license in efforts to retain the social value, memorability, and salience of elements in survivors' testimony at risk of being forgotten in changing sociopolitical environments. For example, Kataribe could engage with either the Japanese public's inability to date the atomic bombing or Europe's widespread feelings of powerlessness described above.

Kataribe aids historical preservation, when working in tandem with other forms of A-bomb storytelling, not as the preferred means of dissemination.

In a post-Hibakusha world, an individual acting as a Legacy Successor may convey the same survivor testimony when acting as Kataribe — possessing identical historical knowledge and training. When acting as Legacy Successor, the storyteller prioritizes historical fidelity. When acting as Kataribe, the storyteller prioritizes amplifying affective ties between the audience and the disaster location of the same events. However, this may require an expansion of Nagasaki's official definition of the Kataribe concept, which currently requires direct personal experience. If trained using the Fukushima model of not requiring direct personal experience, the act of Kataribe storytelling could enable a much wider group to recount Nagasaki's experience in a post-Hibakusha world.

Unofficial Commemoration

Every 9th of August, communities across the world embody and perform unofficial memorial practices. In Nagasaki, the Urakami catholic community holds mass, undertakes a procession from the Urakami Cathedral to Peace Park displaying the statue of *Hibaku Maria* (who symbolizes a wordless fellow sufferer), and engages in oral discussions about the current meaning of Nagasaki's experience. While the Catholic features of this memorial practice are somewhat misaligned from Nagasaki's secular official ceremony, its religious aspects capture important elements neglected in official commemoration about Nagasaki's atomic bombing.⁹⁵

Kataribe can (critically) engage with the concepts, traditions, rituals, and stories that stem from

95 Approximately 8,500 Catholic Hibakusha died in 1945 and many of the survivors were Catholic. See: McClelland, Gwyn. "Dangerous memory in Nagasaki: Prayers, protests and Catholic survivor narratives". Routledge (2019).

Urakami's cultural history in ways that *Densho-sha* and *Kazoku-densho-sha* would struggle with due to their state sponsorship. The local community's decision to rebuild a new Urakami Cathedral, despite the Nagasaki government's desire to preserve it as a "world heritage" tourist destination and "civic memorial", shows how governmental commemorative plans can conflict with the needs and desires of local communities. After the 1958 demolition, a new cathedral was rebuilt and now stands in Urakami, subject to ongoing controversies.⁹⁶ The new building, as a disaster site, enables the memory of Nagasaki's experience (understood not as facts, but as an embodied and performed practice) to be tied to other socially valuable and psychologically appealing religious rituals and ideas, such as mass, weddings, and the Virgin Mary. Kataribe's storytelling flexibility can address elements from Hibakusha's pre-war and post-war experiences — including those tied to religious persecution, exile, and discrimination in the pre-war, but also those of hope, faith, and transnational collaborations⁹⁷ — and make them more salient via oral storytelling in unofficial ceremonies.

Among the varied interpretations of why the atomic bomb was dropped on Urakami, Catholic physician and author Takashi Nagai proposed that A-bomb victims were "a burnt sacrifice" and that survivors were sinners subjected to a divine trial.⁹⁸ This interpretation articulated strong moral and theological claims about guilt, sacrifice, and divine intention that were and remain contestable. Nagai's framing of victims as a sacrificial offering may simultaneously console some survivors while unsettling others. Nagai's interpretation may have become prominent in local discourse because it provided a coherent moral narrative that located the decision to detonate the bomb over Urakami within God's will, redirected rage away from the United States, and prevented nihilistic emotions by making room for hope. All of these elements aligned with the interests of the U.S. occupation. In this sense, Nagai's interpretation functioned as a socially valuable meme: a narrative that

96 McClelland (2019) argues that Nagasaki communities were 'fissured' before the atomic bomb, as Catholic communities and others in the Urakami area (e.g. *burakumin*) were often considered 'filthy', 'sub-human', or 'cave-dwellers', prompting the postwar idea that the atomic bomb 'cleansed' the area among other domestic interpretations. Regarding the Urakami ruins, there is some debate over whether commemorative ceremonies would have more public engagement had the Urakami Cathedral been preserved. See: Gwyn McClelland, "Remembering the Ruins of the Urakami Cathedral: Providence or Fifth Persecution?," *Journal of Religion in Japan* 5, no. 1 (2016): 47-69.; Tomoe Otsuki, "The Politics of Reconstruction and Reconciliation in US-Japan Relations—Dismantling the Atomic Bomb Ruins of Nagasaki's Urakami Cathedral," *Asia-Pacific Journal* 13, no. 32 (2015): e2.

97 See: Naoko Abe, *The Martyr and the Red Kimono: A Fearless Priest's Sacrifice and A New Generation of Hope in Japan* (New York: Random House, 2024).

98 Takashi Nagai, *The Bells of Nagasaki* (New York: Random House, 2025).

flourished in the post-war occupation environment. On the one hand, it passed down the idea that the atomic bomb was an act of divine providence, thereby removing responsibility from the United States. On the other hand, it offered survivors an interpretation that did not rely on hatred of the enemy.

Kataribe have the flexibility to critically engage with religious and controversial features in a way that officially authorised storytellers would struggle to, including with the perspectives of Hibakusha, such as Nagai. An example of this is the way that Nagai's interpretation has been challenged,⁹⁹ and by tying stories to other socially valuable ideas in the present. Kataribe engagement is important not to debate and adjudicate whether Nagai's interpretation was 'right', but to keep stories that stem from unofficial commemorative spaces alive and meaningful, even when official memorial spaces may disregard them.

As we approach a post-Hibakusha world, the creation of Legacy Successors implicitly reflects the value placed on human storytellers. Government authorities have chosen "more human testimony" to "fill the place and function of [Hibakusha's] human testimony" – even if performers of memory lack direct experience of nuclear harm.¹⁰⁰ However, the strict training and supervision Legacy Successors undergo gives them little flexibility to engage with controversies, non-secular spaces, and Hibakusha's post-war experiences, and they are otherwise unable to take advantage of the strengths of oral traditions. In contrast, Kataribe can engage with issues neglected in (un)official commemorative ceremonies and secular/religious spaces, and convey more rhythmic, aesthetic, relatable, accessible, and emotional narratives. Since Kataribe stories need not be sanctioned by state or religious authorities, memories at risk of being forgotten can be brought back to the surface by Kataribe when the pool of competing memes or the evolving needs of government/communities may require it. Internationally, religious communities may neglect Nagasaki's experience in a variety of ways,¹⁰¹ offering discour-

sive spaces where Kataribe can help make sure that Nagasaki is remembered.

Challenge Two: Misremembering Nagasaki

In a post-Hibakusha world, Nagasaki's experience can be misremembered by oversimplification, conflation with Hiroshima's history (treated as the same event/lessons), or misrepresentation. For example, in Japan, the dichotomy that while "Hiroshima rages, Nagasaki prays" (in Japanese, *ikari no Hiroshima, inori no Nagasaki*)¹⁰² indicates that Nagasaki's experience is distinct from Hiroshima's, but it presents a possibly oversimplified narrative that assumes Hibakusha's experiences are well-encapsulated by those two main themes.¹⁰³ In Europe, the "memory of the atomic bombings is overwhelmingly a memory of Hiroshima",¹⁰⁴ showing that Nagasaki's experience is often lumped under the umbrella term 'Hiroshima', which is used as a shorthand for both events. More recently, generative artificial intelligence (GAI) threatens to reconstruct the memory of Nagasaki's experience, presenting narratives as facts when the stories it generates are not based on survivor testimony or historical records. Its 'generative' aspect makes GAI not just historically unreliable, but it may also lead to a re-symbolisation or digital distortion of Hibakusha's experiences through processes not led by human agency.¹⁰⁵

Previously, the memory of Nagasaki's experience has weathered challenges of misrepresentation, such as overcoming censorship during the post-war U.S. occupation or Cold War ideological struggles.¹⁰⁶ Hoskins suggests that, in the 21st century, the memory of Nagasaki's experience will need to overcome the saturation of online memory due to too much information being available on the internet and the advent of GAI, which extracts, remixes, and replays versions of the past in seemingly novel ways but in a process that does not always involve human agency.¹⁰⁷ Kataribe can play an important role

99 In 1981, Pope John Paul II gave an open-air mass in Nagasaki and a public sermon at Hiroshima's cenotaph. In Hiroshima, the Pope stated that 'War is the work of Man' (as opposed to that of God's). According to Richard Lloyd Parry, the Pope's sermon was a rebuttal of Nagai's doctrine, offering Nagasaki's Hibakusha a "turning point in their thoughts and feelings about the bomb, and the stimulus to a new era of peace activism." See: Nagai, Takashi. *The bells of Nagasaki*. Random House (2025): xxv-xxvi. *Op. Cit.*

100 van der Does and Hoskins, "Fall of Living Memory: Forgetting the Atomic Bombings of Japan," 35.

101 For a review of religious interpretations of nuclear weapons, see: Emmanuelle Maitre, "Is Nuclear Deterrence Morally Defensible? Religious Perspectives," *Fondation pour la Recherche Stratégique* 5 (2016): 27; Stephen Kierulff, "Belief in 'Armageddon Theology' and Willingness to Risk Nuclear War," *Journal for the Scientific Study of Religion* 30, no. 1 (1991): 81–93, <https://www.jstor.org/stable/1387150>.

102 Kevin M. Doak, "Hiroshima Rages, Nagasaki Prays," in: *When the Tsunami Came to Shore Culture and Disaster in Japan* (2014), 249.

103 See Timothy Iles, "'Inori no Nagasaki'?" *Electronic Journal of Contemporary Japanese Studies* (2022); McClelland, *Dangerous Memory in Nagasaki: Prayers, Protests and Catholic Survivor Narratives*. *Op. Cit.*

104 Sterre van Buuren et al., "Nuclear Memories for the Future: Gaps and Forgetting in European Publics' Understandings of the Atomic Bombings of Hiroshima and Nagasaki," *Thesis Eleven* (2025): 2.

105 See: Andrew Hoskins, "AI & Collective Memory," *Current Opinion in Psychology* (2025): 102156.

106 Lawrence S. Wittner, "Confronting the Bomb: A Short History of the World Nuclear Disarmament Movement," (Stanford: Stanford University Press, 2009).

107 Hoskins, "AI & Collective Memory." *Op. Cit.*

in retaining human agency in increasingly digitally enabled memorial practices.

Digital technologies will play an important role in preserving and channelling information about Nagasaki's experience. As the past is digitalised, distinct historical visions are curated into online websites that store, represent, and display artefacts, witness-based stories, and materials derived from Nagasaki's nuclear past.¹⁰⁸ While Nagasaki's online resources are not as abundant as Hiroshima's, a wide variety of sites exist. These range from interactive 3D maps of Nagasaki that display Hibakusha testimonies shown at the location they were when the bomb detonated (with additional stories about how they were impacted in later life)¹⁰⁹ to digital galleries that aim to 're-story' the nuclear past to address perceived shortcomings in ongoing public discussions.¹¹⁰ Some digital memorials are dedicated to specific issues, for example children killed in Hiroshima and Nagasaki,¹¹¹ and others function as more general digital museums.¹¹² Many of these websites emerged in response to commemorative anniversaries and the decreasing Hibakusha population, and were intended as educational resources about unaddressed risks associated with nuclear weapons.

A significant number of people use online resources not just as a source of knowledge but as a guide for "dark tourism" – understood as "modern mass travel to destinations associated with disaster, murder, and mass death".¹¹³ While some travellers visit sites for pleasure and leisure, others look for sights and insights about dangers associated with technologies, ideologies, and political trends.¹¹⁴ In Nagasaki, online tourist guides recommend that visitors go to specific

museums and disaster sites.¹¹⁵ Kataribe can storytell at those sites, offering emotions/lessons learned to tourists that are not sponsored by the state/religious organisations nor motivated by private profit, and which instead aim to function as vehicles of community empathy, prompting visitors to see themselves in the dangers associated with Nagasaki's memory.¹¹⁶ Online resources are easy to erase, fake, edit, and share – not necessarily more reliable than human memory.

While some degree of misrepresentation may be unavoidable, Kataribe can at least provide contrasting narratives that complement those provided at museums, commemorative ceremonies, and in popular culture.

In 2020, the Nagasaki Atomic Bomb Victims Memorial Museum, in collaboration with the company Silvacompass, developed an 'AI storyteller' prototype device. Nagasaki City has discontinued its involvement with the project, but Silvacompass has continued working on it.¹¹⁷ AI-enabled Hibakusha testimonies have been framed as innovative, sustainable, and safe from misrepresentation. Developers argue their interface can be designed to ensure that GAI models only use words used by Hibakusha in their original form, without deviation, and respond with 'I don't know' rather than providing incorrect answers when needed.¹¹⁸ Government and private institutions may not resist temptations to use GAI technologies that promise to capture Hibakusha's

108 Victoria Grace Walden, ed., *The Memorial Museum in the Digital Age* (Falmer, UK: REFRAME Books, 2022), https://reframe.sussex.ac.uk/wp-content/uploads/2022/12/Memorial_Museum_in_Digital_Age_Hires.pdf.

109 Hidenori Watanabe, "Nagasaki Archive," accessed October 20, 2025, https://n.mapping.jp/index_en.html.

110 John Sullivan, "ReStorying' History While Examining Oppenheimer," Lesley University, 2023, <https://lesley.edu/news/restorying-history-while-examining-oppenheimer>.

111 ICAN, "ICAN Launches Memorial to Children Killed in Hiroshima and Nagasaki," 2025, accessed October 20, 2025, <https://www.icanw.org/ican-launches-memorial-to-children-killed-in-hiroshima-and-nagasaki>.

112 For example, Atomic Heritage Foundation. "Bombings of Hiroshima and Nagasaki – 1945," accessed October 20, 2025, <https://ahf.nuclearmuseum.org/ahf/history/bombings-hiroshima-and-nagasaki-1945/>.

113 Rudi Hartmann et al., "The History of Dark Tourism," *Journal of Tourism History* 10, (3): 7.

114 Malcolm Foley and J. John Lennon, "JFK and Dark Tourism: A Fascination with Assassination," *International Journal of Heritage Studies* 2, no. 4 (1996): 198–211; <https://www.tandfonline.com/doi/abs/10.1080/13527259608722175>; Mircea Petroman and Iancu Tiberiu, "Atomic Tourism Subtype of Dark Tourism," *Agricultural Management/Lucrari Stiintifice Seria I, Management Agricol* 23, no. 1 (2021); Stefanie Schäfer, "From Geisha Girls to the Atomic Bomb Dome: Dark Tourism and the Formation of Hiroshima Memory." *Tourist Studies* 16, no. 4 (2016): 351–366.

115 For example, see: Japan National Tourism Organization, "Urakami Cathedral," accessed October 20, 2025, <https://www.japan.travel/en/spot/734/>; Travel Nagasaki, 山里小学校 [Yamazato Elementary School], accessed October 20, 2025, <https://en.at-nagasaki.jp/spot/61038>; Travel Nagasaki, 城山小学校 (城山小学校平和祈念館) [Shiroyama Elementary School Peace Memorial Hall], accessed October 20, 2025, <https://en.at-nagasaki.jp/spot/61039>.

116 Some educational applications of nuclear tourism have been found to influence beliefs of acceptability in nuclear-related subjects. See: Kyungjae Jang et al., "Dark Tourism as Educational Tourism: The Case of 'Hope Tourism' in Fukushima, Japan," in *Dark Tourism Studies*, (London: Routledge, 2022), 104–115; Natalija Mažeikiene et al., "Educational Aspects of Nuclear Tourism: Sites, Objects and Museums," in *EDULEARN18 Proceedings*, (Valencia: IATED, 2018), 5668–5677.; Kaori Yoshida, Huong T. Bui, and Timothy J. Lee, "Does Tourism Illuminate the Darkness of Hiroshima and Nagasaki?" *Journal of Destination Marketing & Management* 5, no. 4 (2016): 333–340.

117 In 2021, NHK launched an AI-generated avatar of a Hibakusha functioning as an 'AI-based Testimony Response Device' based on the experiences of survivor Yoshiko Kajimoto. See: Andrew Hoskins, "AI and memory." *Memory, Mind & Media* 3 (2024): e18, 9.

118 Van der Does and Hoskins, "Fall of Living Memory: Forgetting the Atomic Bombings of Japan," 36–37. *Op. Cit.*

last moments of living memory.¹¹⁹ Moreover, GAI can claim to be better at remembering the past than any human in a post-Hibakusha world, as the industry claims to exceed what is humanly possible to remember and legitimises its authenticity by having trained its language models on Hibakusha testimony. Therefore, in a post-Hibakusha world, GAI devices may see themselves as better than *Densho-sha*, *Kazoku-densho-sha*, and Kataribe at recalling Nagasaki's nuclear experience.

Kataribe can consequently play an important role in problematising how Nagasaki's experience may be digitally oversimplified and conflated locally and abroad, keeping alive the act and spirit of Hibakusha's human-based oral testimony. In replicating the oral traditions that Hibakusha engaged in, Kataribe can keep a human narrator as a central component of embodied and performed memories reproduced through dark tourism and GAI. Kataribe can be vehicles of human legitimacy in issues that go beyond the scope of *Densho-sha* and *Kazoku-densho-sha*, making sure that 'generative' and 'creative' reinterpretations of Hibakusha's memory remain in the hands of humans, rather than GAI.

Challenge Three: Purposeless Memory of Nagasaki's Experience

The third challenge relates to the allocation of purpose. In other words, what is Nagasaki's experience remembered for? The act of recalling Nagasaki's experience implies the existence of a purpose, which may range from honouring the past, to preserving the status quo of avoiding the future use of nuclear weapons in warfare, accidents, or preventing proliferation, to more radical social transformations, such as pursuing nuclear abolition and disarmament. These goals are influenced by perceptions of historical constraints and opportunities. Despite some disagreements, organisations that employ Hibakusha's memory in their political discourse usually display a "shared commitment to the pursuit of the abolition of nuclear weapons".¹²⁰ For some scholars, the nuclear threat requires

a global and intergenerational expansion of our "horizon of responsibility".¹²¹

Kataribe can be suggestive of purpose, actively linking their stories to changing political and educational spaces, aiding with the attribution of meaning to nuclear weapons and the memory of Nagasaki's experience.

In political spaces, Kataribe can pass down feelings expressed by Hibakusha regarding their hopes and disappointments with treaties such as the Treaty on the Prohibition of Nuclear Weapons (TPNW).¹²² As narratives of renewed nuclear risks can make states less inclined to adopt disarmament policies,¹²³ Kataribe can help to orally articulate what Nagasaki's experience is being remembered for in the 21st century and beyond, through evolving political landscapes.

For example, Hibakusha's oral testimonies have been a key characteristic of school-based education in Nagasaki and Hiroshima cities. For Japanese students outside Nagasaki and Hiroshima Prefectures, however, school excursions enable only a small number of young people to listen to Hibakusha's testimonies.¹²⁴ Internationally, Hibakusha storytelling is being incorporated into some recent initiatives, exemplified by the United Nations Office for Disarmament Affairs' Youth Leader Fund for a World Without Nuclear Weapons programme. Their latest iteration is focused on training young people from all around the world in 'storytelling' that engages with Hibakusha's memories.¹²⁵ Kataribe can help incorporate locally-grounded emotions in these educational spaces, helping institutions navigate contested views of the past, questions of neutrality, and classifica-

119 Amanda Lagerkvist, "The Netlore of the Infinite: Death (and Beyond) in the Digital Memory Ecology," *New Review of Hypermedia and Multimedia* 21, no. 1-2 (2015): 185-195; Carl Öhman and Luciano Floridi, "The Political Economy of Death in the Age of Information: A Critical Approach to the Digital Afterlife Industry," *Minds and Machines* 27, no. 4 (2017): 639-662.; Davide Sisto, *Online Afterlives: Immortality, Memory, and Grief in Digital Culture* (Cambridge, MA: MIT Press, 2020).

120 Van der Does and Hoskins, "Fall of Living Memory: Forgetting the Atomic Bombings of Japan," 33. *Op. Cit.*

121 Günther Anders, "Theses for the Atomic Age," *The Massachusetts Review* 3, no. 3 (1962): 493-505, <http://www.jstor.org/stable/25086864>.

122 Jonathon Baron, Rebecca Davis Gibbons, and Stephen Herzog, "Japanese Public Opinion, Political Persuasion, and the Treaty on the Prohibition of Nuclear Weapons," *Journal for Peace and Nuclear Disarmament* 3, no. 2 (2020): 299-309. <https://www.tandfonline.com/doi/full/10.1080/25751654.2020.1834961>.

123 Tom Vaughan, "The 'Third Nuclear Age' is a Politically Motivated Label that Seeks to Justify a Renewed Arms Race," *Nuclear Times*, 2025.

124 Ogawa, "Kataribe Storytellers: How Can Firsthand Experiences of War and Disaster be Passed on to Future Generations?," 157-176. *Op. Cit.*

125 United Nations Regional Information Centre for Western Europe, "Youth Leader Fund for a World Without Nuclear Weapons (YLF)," accessed September 23, 2025, <https://unric.org/en/fsg-youth-leader-fund-for-a-world-without-nuclear-weapons-ylf/>.

tions of appropriateness.¹²⁶ Most education about Nagasaki's history already comes from teachers who lack direct experience of nuclear harm. Kataribe can help educators transcend models of education that focus on transmitting facts, and instead teach for social transformation – not only on an informative basis, but by engaging with pedagogical materials based on Nagasaki's experience,¹²⁷ like some Hibakusha have done.

If the past is “the result of negotiation and debate”,¹²⁸ Kataribe can function as mediators of meaning and purpose in the practice of memory. Deliberate training, funding, and collaborations with Legacy Successors may provide Kataribe with a higher perception of legitimacy or copying fidelity. As long as nuclear disarmament is being managed, Kataribe can be seen as an essential feature of Nagasaki's A-bomb disaster management,¹²⁹ retaining the fecundity of the memory of Nagasaki's experience and of its purpose.

¹²⁶ While beyond the scope of this article, Kataribe can engage with critical variations of peace and disarmament education initiatives, which aim to transcend the educational emphasis on ‘facts’, aiming to inspire action in young students. For more, see: Samuel Bowles and Herbert Gintis, *Schooling in Capitalist America: Educational Reform and the Contradictions of Economic Life* (New York, NY: Basic Books, 1976); Paulo Freire, “Pedagogy of the Oppressed,” in *Toward a Sociology of Education*, 374-386 (London: Routledge, 2020); Yumiko Nogami, “Nuclear Disarmament Education and the Experiences of Hiroshima and Nagasaki,” *ISYP Journal on Science and World Affairs* 2, no. 1 (2006): 9-17.; United Nations General Assembly, United Nations Study on Disarmament and Non-proliferation Education, Report of the Secretary-General, “Fifty-seventh session, item 67 (c) of the provisional agenda General and complete disarmament, A/57/124 (New York: United Nations, 2002), accessed September 23, 2025, <https://digitallibrary.un.org/record/474908?ln=en&v=pdf>.

¹²⁷ Jill Petersen Adams, “High Fidelity: Pedagogy and Postatomic Japanese Chronicle,” *Cultural Studies-Critical Methodologies* 22, no. 2 (2022): 214-224.

¹²⁸ Vera L. Zolberg, “Contested Remembrance: The Hiroshima Exhibit Controversy,” *Theory and Society* 27, no. 4 (1998): 565. <http://www.jstor.org/stable/657840>.

¹²⁹ Ogawa, “Kataribe Storytellers: How Can Firsthand Experiences of War and Disaster be Passed on to Future Generations?”, 157-176. *Op. Cit.*

Conclusion

Kataribe are an important human vehicle whereby cultural information based on Nagasaki's experience of a nuclear bombing can be made more enduring in a post-Hibakusha world.

Like other oral traditions – which sacrifice longevity and copying fidelity but are strongest at making stories more psychologically appealing, relatable, and meaningful – Kataribe can help prevent the collective oblivion, misrepresentation, and purposelessness of Nagasaki's experience in a post-Hibakusha World, primarily by replicating Hibakusha's act of disaster oral storytelling and the advantages of their human agency. In contrast to *Densho-sha* and *Kazoku-densho-sha*, who focus on facts about 1945, Kataribe are uniquely well-equipped to evoke empathy, transmit emotions, articulate lessons learned, and adapt stories to dynamic memorial practices in secular/religious spaces. Due to the saturation of online information and the emergence of stories produced by generative artificial intelligence, Kataribe can help preserve the cultural fecundity of human-made stories tied to Nagasaki's nuclear past in digitally-enabled times.

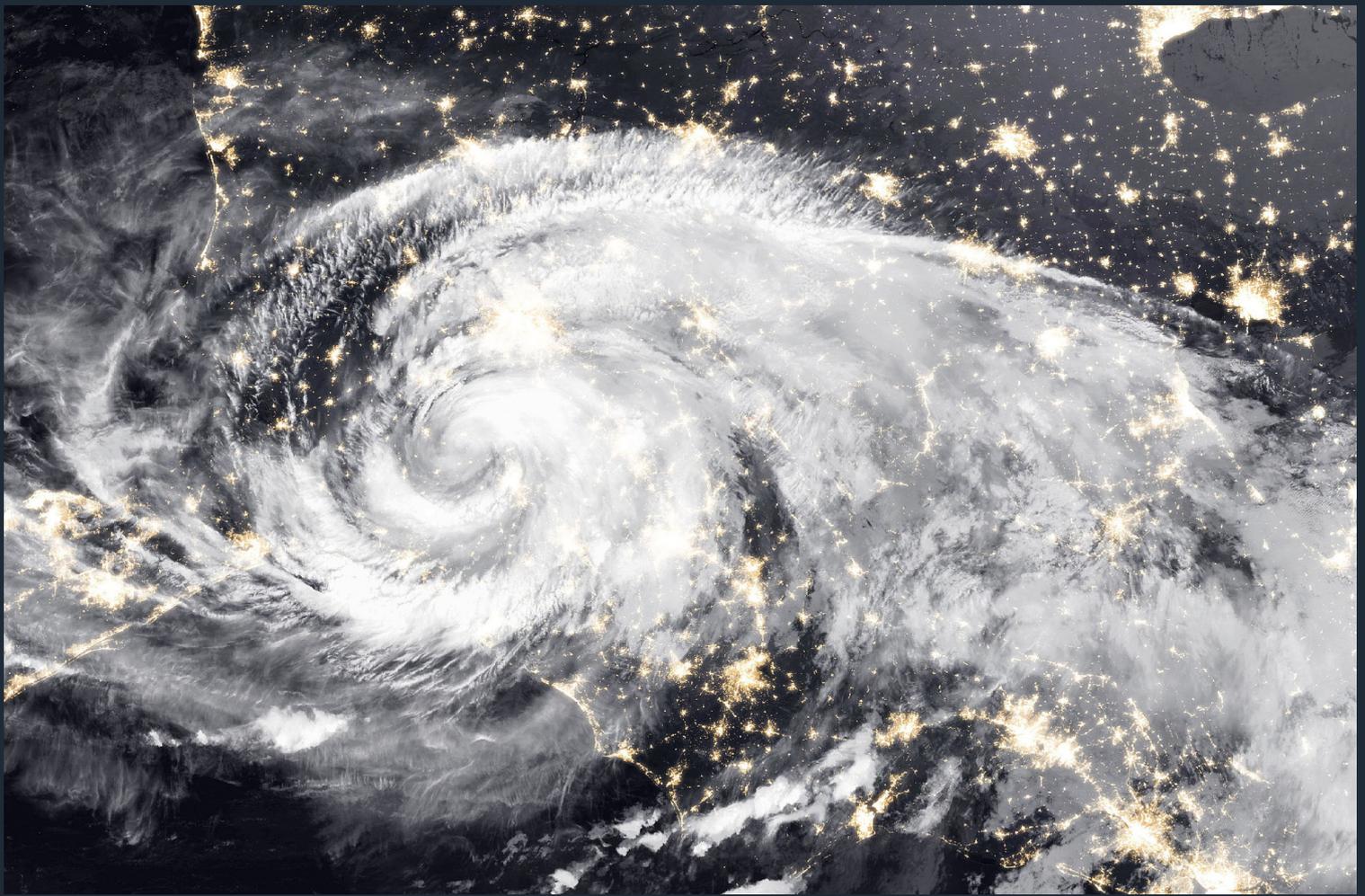
In a post-Hibakusha world, Kataribe can work alongside Legacy Successors. While the latter ensures the copying fidelity of historical facts, the former can allocate purpose to the memory of Nagasaki's experience. However, this would require a re-definition of the concept of Kataribe as it is currently understood by Nagasaki officials. Should the definition remain restricted to those with direct experience, there will be no Kataribe in a post-Hibakusha world.

The act of storytelling about Nagasaki's experience will always be imperfect and incomplete. Descriptions of what happened in Nagasaki in 1945 and why these memories matter will continue to evolve and be contested. Remembering Nagasaki's experience in a way that honours Hibakusha memory, therefore, entails not necessarily a complete and accurate knowledge of the past, but an approximation to its purpose in view of contemporary nuclear challenges.



Based on the discussion and conclusions presented herein, we recommend the following:

- Engaging Hibakusha in a consultative process on whether or how their testimonies may be accessed by GAI. While this would not necessarily preclude GAI's access to their testimonies, it could strengthen Kataribe's (and other oral storytellers') legitimacy;
- Nagasaki authorities should revisit and potentially expand the definition of *Kataribe*, establishing under what conditions it may extend to narrators without direct experience;
- Nagasaki's local government, museums, universities, and civil society associations could seek sponsors and prospective trainees interested in becoming Kataribe both within Japan and internationally. If Kataribe without direct experience began storytelling activities alongside Hibakusha while this still remains possible, this could strengthen future trust in Kataribe as disaster storytellers rooted in Nagasaki's experience.



WORKING GROUP 3

The Tale of Fire and Ice: Communicating The Nexus Between the Twin Existential Threats of Climate Change and Nuclear Weapons

GROUP MEMBERS:

Galina Salnikova
Christelle Barakat
Emily Day
Hikari Katsuki
Waka Kuwahara

Introduction

“When we call these dangers existential, that is exactly what we mean: They threaten the very existence of civilization.”¹³⁰

– Bulletin of the Atomic Scientists, 2016

Nuclear weapons and climate change are often discussed by the public, governments, and academia as distinct global challenges, yet are inextricably linked: they are “twin existential threats”.¹³¹ The use of nuclear weapons and testing would have severe environmental and humanitarian consequences,¹³² while climate change undermines the safety of nuclear infrastructure.¹³³ Communicating the nuclear-climate nexus is therefore essential to raising public and political awareness.

Yet, communication of this nexus faces barriers that limit public understanding, policymaking, and global engagement. These include limited studies and discussions on the nexus, as well as the high technical complexity of the issues.

This study explores how to communicate this nexus in clear and compelling ways to build public understanding and political will to prevent irreversible damage to people and the planet. It highlights how framing and narratives, scientific evidence, familiar and innovative formats such as movies and social media, intergenerational and multi-stakeholder collaboration can be used to raise awareness, bridge emotional and cognitive gaps, and inspire collective action. This paper draws on insights from communication theory on the foundations of effective communication and dives deeper into Hibakusha testimonials and movie portrayals to make the nexus more accessible while highlighting gaps. The movies we considered as case studies for communicating the nexus were: *Oppenheimer*, *Nagasaki: In*

the Shadow of the Flash, and an independent movie, *JARA – Radioactive Patriarchy*.

Additionally, this paper provides a set of recommendations, including rethinking nuclear-climate terminology; strengthening framing, storytelling, and public narratives; empowering trusted messengers — especially youth and affected communities; and building multi-stakeholder platforms for sustained dialogue.

Definitions

We define *climate change* as any significant change in the measurements of climate, including major changes in temperature, precipitation, or wind patterns, lasting for an extended period of time.¹³⁴ For the purpose of this study, we expand the scope to include environmental damage and humanitarian consequences (mostly related to human health) inflicted in the short term but posing a long-term impact on climate change, such as pollution, including radioactive pollution, physical damage to ecosystems, and human health hazards. Using an expanded scope allows for a comprehensive analysis of both the immediate and cumulative impacts of nuclear weapons usage and testing.

Nuclear weapons refers to accidental, mistaken, unauthorised, or intentional nuclear detonations, and the risk of these events occurring.¹³⁵ Accidental nuclear detonations include those potentially provoked by weather events; intended ones include an actual nuclear conflict as well as nuclear testing.

The Nuclear-Climate Nexus

The nexus between nuclear weapons and climate change reflects a mutually reinforcing relationship where each threat magnifies the other. Climate change amplifies nuclear risks¹³⁶ by destabilising nuclear infrastructure. Extreme weather endangers military installations¹³⁷ and increases the potential for accidents at civilian nuclear power plants.¹³⁸ At the same time, nuclear weapons constitute a climate

130 Science and Security Board, “January 2016 Doomsday Clock Statement: It Is Still Three Minutes to Midnight,” *Bulletin of Atomic Scientists*, January 2016, <https://thebulletin.org/wp-content/uploads/2016/11/January-26-2016-Doomsday-Clock-Announcement-Final.pdf>.

131 Jasmine Auda et al., “The Dual Threat of Nuclear Weapons and Climate Change: The Danger of Inaction,” in *De-Siloing Existential Threats: Challenging Identity, Power, and Inclusivity in the Nuclear Policy Field*, ed. K. Obergfaell (London: BASIC, 2023), 16–25, <https://basicint.org/anthology-de-siloing-existential-threats/>.

132 Lila Xia et al., “Global Food Insecurity and Famine from Reduced Crop, Marine Fishery and Livestock Production due to Climate Disruption from Nuclear War Soot Injection,” *Nature Food* 3 (2022): 586–96, <https://doi.org/10.1038/s43016-022-00573-0>.

133 Sarah M. Jordan et al., “The Climate Vulnerabilities of Global Nuclear Power,” *Global Environmental Politics* 19, no. 4 (2019): 3–13, https://doi.org/10.1162/glep_a_00527.

134 U.S. Environmental Protection Agency, “Climate Change: Basic Information,” January 19, 2017, https://19january2017snapshot.epa.gov/climatechange/climate-change-basic-information_.html.

135 Global Academic Foundation, *Moving Forward Together: Harnessing Scientific and Technical Expertise for a Sustainable Future*, A/AC.286/NGO/13 (New York: United Nations, 2024), <https://docs.un.org/en/A/AC.286/NGO/13>.

136 Jordan et al., “The Climate Vulnerabilities of Global Nuclear Power.” *Op. Cit.*

137 Steven Aftergood, “Extreme Weather Threatens Military Falong-Termitities,” *Federation of American Scientists*, August 5, 2019, <https://fas.org/publication/extreme-weather-dod/>.

138 Matthew Fisher, “The Resilience and Safety of Nuclear Power in the Face of Extreme Events,” *IAEA Bulletin* 61, no. 3 (2020), <https://www.iaea.org/bulletin/the-resilience-and-safety-of-nuclear-power-in-the-face-of-extreme-events>.

threat. The detonation of multiple nuclear weapons, whether purposeful or accidental, would ignite fires and generate smoke and radioactive particles that rise into the stratosphere, where they would block sunlight, cool the planet, deplete the ozone layer, and alter precipitation patterns – effects known as nuclear winter.¹³⁹ Nuclear testing also inflicts long-term damage. Atmospheric nuclear testing produced contamination of soil¹⁴⁰ and water and a loss of biodiversity.¹⁴¹ At the Semipalatinsk Test Site in Kazakhstan, nuclear testing contaminated soil with radioactive isotopes such as caesium-137 and strontium-90, leading to contamination 10 to 20 times above permissible standards.¹⁴² This led to groundwater contamination and long-term ecosystem disruption. Biodiversity declined, with some species of birds and animals falling by 50%-70%.¹⁴³ Additionally, the blast force of nuclear testing damaged plant structures and uprooted vegetation, while underwater testing resulted in large fish die-offs and widespread coral destruction.¹⁴⁴ Long-term climate impacts include disruption of the ozone layer, an increase in greenhouse gas emissions, and an impact on atmospheric circulation.¹⁴⁵ Testing also had humanitarian impacts, including various forms of cancer¹⁴⁶ and erosion of cultural lands and practices.¹⁴⁷ Among Japanese Atomic bomb survivors, exposure to 1 gray (Gy) of radiation was associated with a 47% excess relative risk (ERR) for all solid cancers.¹⁴⁸ Communities beyond Japan have experienced this nexus firsthand.

SECTION 1

The Intersection between Nuclear Weapons and Climate Change

The Environmental Consequences of Nuclear War

Scientific evidence over the past four decades has found that even a “limited” nuclear exchange would have catastrophic environmental consequences beyond the immediate blast zones.¹⁴⁹ The use of 50-100 smaller nuclear weapons (each within a 15-kiloton range) against urban areas would inject enough soot into the stratosphere to deplete the ozone layer, disrupt global rainfall patterns, and make vast territories uninhabitable.¹⁵⁰

A 2019 study using two independent climate models – WACCM4 (Whole Atmosphere Community Climate Model v4) and GISS ModelE – found that both large and small-scale scenarios produced multi-year global cooling.¹⁵¹ WACCM4 projected an El Niño-like collapse of the monsoon season – the recurring warming of the Pacific Ocean – for more than 7 years after injection of soot.¹⁵² ModelE, in turn, projected that the soot would persist in the atmosphere for longer, causing a negative impact even after 10 years.¹⁵³

The humanitarian toll would be staggering: a one-week nuclear war between India and Pakistan could kill more than two billion people, while a large-scale exchange between the United States and Russia, for example, could cause over five billion deaths from starvation alone.¹⁵⁴ In either case, Earth’s climate would take more than a decade to recover.¹⁵⁵

139 R.P. Turco et al., “Nuclear Winter: Global Consequences of Multiple Nuclear Explosions,” *Science* 23, no. 222 (1983): 1283–92, <https://doi.org/10.1126/science.222.4630.1283>.

140 Remus Prävölle, “Nuclear Weapons Tests and Environmental Consequences: A Global Perspective,” *Ambio* 43, no. 6 (2022): 729–44, <https://doi.org/10.1007/s13280-014-0491-1>.

141 Alistair Walsh, “How Nuclear Testing Leaves Lasting Environmental Scars,” *Deutsche Welle*, October 12, 2022, <https://www.dw.com/en/nuclear-testing-north-korea-environment-biodiversity/a-63418634>.

142 Raushan Akhmetova et al., “The Impact of Nuclear Testing on the Environment: The Case of the Semipalatinsk Nuclear Test Site,” *Bio Web of Conferences* 141 (2024), <https://doi.org/10.1051/bioconf/202414104039>.

143 *Ibid.*

144 Michael J. Lawrence et al., “The Effects of Modern War and Military Activities on Biodiversity and the Environment,” *Environmental Reviews* 23, no. 4 (2015): 443–60, <https://doi.org/10.1139/er-2015-0039>.

145 Bikini Atoll Local Government, *Environmental Consequences of Atmospheric Nuclear Tests: Long-Term Effects*, April 5, 2024, <https://www.bikiniatoll.info/environmental-consequences-of-atmospheric-nuclear-tests-long-term-effects/>.

146 Remus, “Nuclear Weapons Tests and Environmental Consequences.” *Op. Cit.*

147 Rohan Patel, “Aftermath of Nuclear Testing in the Pacific Islands,” *JCO Global Oncology* 10 (2024), <https://doi.org/10.1200/GO-24-00455>.

148 Radiation Effects Research Foundation, “Site-Specific Cancer Risks Among Atomic-Bomb Survivors,” accessed December 30, 2025, https://www.ref.or.jp/en/programs/roadmap_e/health_effects-en/late-en/site/.

149 Richard Wolfson and Ferenc Dalnoki-Veress, “The Devastating Effects of Nuclear Weapons,” *MIT Press Reader*, March 2, 2022, <https://thereader.mitpress.mit.edu/devastating-effects-of-nuclear-weapons-war/>.

150 O.B. Toon et al., “Atmospheric Effects and Societal Consequences of Regional Scale Nuclear Conflicts and Acts of Individual Nuclear Terrorism,” *Atmospheric Chemistry and Physics* 7 (2007), <https://acp.copernicus.org/articles/7/1973/2007/acp-7-1973-2007.pdf>.

151 Joshua Coupe et al., “Nuclear Winter Responses to Nuclear War Between the United States and Russia in the Whole Atmosphere Community Climate Model Version 4 and the Goddard Institute for Space Studies ModelE,” *Journal of Geophysical Research: Atmospheres* 124, no. 15 (2019): 8522–543, <https://doi.org/10.1029/2019JD030509>.

152 National Oceanic and Atmospheric Administration, “What Are El Niño and La Niña?,” *National Oceanic and Atmospheric Administration*, May 16, 2024, <https://oceanservice.noaa.gov/facts/ninonina.html>.

153 Coupe et al., “Nuclear Winter Responses to Nuclear War.” *Op. Cit.*

154 *Ibid.*

155 *Ibid.*

While some effects unfold within minutes to days, others would intensify over time. For example, a 2006 study modelled a 10-kiloton nuclear detonation in the Port of Long Beach, finding that the detonation would result in economic losses that exceed \$1 trillion, compared to \$50 billion in costs from 9/11.¹⁵⁶ Over time, economic impacts would spread as global shipping is disrupted, insurance and real estate markets are strained, and major financial centres are destabilised.

The US National Academies of Sciences, Engineering, and Medicine, in a 2025 report, explored these pathways by mapping the causal chain from nuclear weapons detonation to its resulting environmental and societal effects, including firestorms, soot production, atmospheric transportation of particles, ecosystem disruption, and human impacts.¹⁵⁷ The thermal energy released would cause burns and ignite fires, while overpressure would damage infrastructure and create secondary fires. Surface bursts or low altitude airbursts would loft debris into a mushroom cloud, producing highly radioactive local fallout within hours, and could also produce longer-lasting global fallout from smaller particles. The combined effects could create emissions greater than material within the nuclear cloud, and these emissions could reach the stratosphere, creating long-lasting regional and global environmental impacts.¹⁵⁸

The environmental and climate impacts of nuclear war scenarios would unfold across time and differ based on the amount of nuclear weapons used. Immediate impacts would include injected emissions and smoke, which would deplete stratospheric ozone, increasing radiation at Earth's surface and causing ecosystem damage. Subsequent impacts would include the rapid cooling of land surfaces, slower but longer-lasting ocean temperature changes, and hydrologic changes as changes in radiation levels and cooling affect precipitation, impacting the availability of freshwater. Changes in wind and ocean chemistry would disrupt ocean circulation, while cryosphere impacts could amplify cooling. These physical changes would then impact ecosystems and our societies. Broader biodiversity impacts, though uncertain, could include habitat shifts, extinction of local species, and colonisation of abandoned land. Agriculture and livestock production would thus be

impacted by global cooling, freshwater availability, and changes to precipitation. However, scenario modelling of nuclear war environmental and climate impacts differs from longer-term climate change, as a sudden cooling would not allow for gradual adaptation. This compounds uncertainties related to the severity of various scenarios and the environmental and societal responses.¹⁵⁹

While the National Academies report confirms that the environmental, climate, societal, and economic risks of nuclear war are real and interconnected, it highlights that uncertainties and data gaps exist at every stage of the causal chain, making the severity of different nuclear detonation scenarios difficult to predict. To address this, the report recommends, among others, the coordination and development of model intercomparison projects (MIPs) to better assess and reduce uncertainties and improve projections of the environmental and climate impacts of various scenarios of nuclear war.¹⁶⁰

Climate Risks to Nuclear Infrastructure

While nuclear conflict can trigger climatic disruption, climate change in turn jeopardises the safety of nuclear infrastructure.¹⁶¹ Rising temperatures, sea levels, and extreme weather events endanger both civilian nuclear energy facilities and military nuclear installations.¹⁶²

Nuclear power plants rely heavily on stable water supplies for cooling, making them sensitive to hydrological change.¹⁶³ Droughts and heatwaves can reduce cooling efficiency, while biological contamination and debris can clog intake systems.¹⁶⁴ Coastal reactors¹⁶⁵ and nuclear waste storage sites¹⁶⁶ are increasingly exposed to sea-level rise and flooding, and military infrastructure is similarly vulnerable. A 2019 assessment found that the U.S. Department of Defense maintains roughly 1,700 coastal installations

¹⁵⁹ *Ibid.*

¹⁶⁰ *Ibid.*

¹⁶¹ Office for Nuclear Regulation, "Climate Change Report Highlights More Work Required by Industry," July 24, 2025, <https://www.onr.org.uk/news/all-news/2025/07/climate-change-report-highlights-more-work-required-by-industry>.

¹⁶² Joana Portugal-Pereira et al., "Exposure of Future Nuclear Energy Infrastructure to Climate Change Hazards: A Review Assessment," *Energy Strategy Reviews* 53 (2024), <https://doi.org/10.1016/j.esr.2024.101365>.

¹⁶³ *Ibid.*

¹⁶⁴ *Ibid.*

¹⁶⁵ Nuclear Energy Agency, *Climate Change: Assessment of the Vulnerability of Nuclear Power Plants and Approaches for Their Adaptation*, NEA no. 72027 (Paris: OECD Nuclear Energy Agency, 2021), https://www.oecd-nea.org/upload/docs/application/pdf/2021-11/nea7207_climate_change_adaptation.pdf.

¹⁶⁶ U.S. Government Accountability Office, *Nuclear Waste: Changing Conditions May Affect Future Management of Contamination Deposited Abroad During U.S. Cold War Activities*, GAO-24-104082 (Washington DC: U.S. Government Accountability Office, January 31, 2024), <https://www.gao.gov/products/gao-24-104082>.

¹⁵⁶ Charles Mease and Roger C. Molander, *Considering the Effects of a Catastrophic Terrorist Attack*, (Santa Monica, CA: Rand Corporation, 2006), https://www.rand.org/pubs/technical_reports/TR391.html.

¹⁵⁷ National Academies of Sciences, Engineering, and Medicine, *Potential Environmental Effects of Nuclear War* (Washington, DC: National Academies Press, 2025), <https://doi.org/10.17226/27515>.

¹⁵⁸ *Ibid.*

that are at risk from rising sea levels.¹⁶⁷ For example, in 2018, Hurricane Michael caused \$4.7 billion in damage to Tyndall Air Force Base in Florida,¹⁶⁸ demonstrating how extreme weather can cripple national security assets. Comparable risks threaten nuclear sites in other countries located near coasts or major rivers, from Europe to East Asia.

These converging dangers highlight a feedback loop: as the planet warms, the physical stability of nuclear facilities declines, raising the likelihood of accidents and contamination.

SECTION 2

Communicating the Nexus: Theory

Issues in Communicating the Nexus

Communicating the nexus faces barriers that limit public understanding, policymaking, and global engagement.

The first barrier is *conceptual fragmentation*. Despite their profound interconnection, climate change and nuclear weapons are often treated as separate issues in policy documents, academic literature, and political debates, rather than as interacting threats.¹⁶⁹

Another barrier exists in how information is communicated. Both topics are technically complex, posing challenges for public understanding and media narratives. For instance, nuclear winter research often involves highly technical scenario modelling. Studies have found that people seek information when they feel uncertainty, triggering anxiety and other negative emotions, which do not always lead to evidence-based and highly technical understanding.¹⁷⁰ Without trusted sources that translate scientific findings into relatable narratives in accessible

language,¹⁷¹ public discourse risks being dominated by misinformation, disinformation, and speculation.¹⁷²

Foundations of Effective Communication

Communication theory identifies the following essential elements for fostering engagement: *framing, messaging, and storytelling*.¹⁷³ As Lakoff and Nisbet emphasise, effective *framing* translates scientific information into narratives grounded in shared cultural values, making abstract risks personally meaningful and actionable.¹⁷⁴ Action-oriented tailored *messaging* should support clear and grounded narratives, showing that individuals and societies can make tangible contributions to addressing threats wherever they are in life, based on incentives and the use of terminology fit for different audiences.¹⁷⁵ *Storytelling*, in turn, allows people to emotionally relate to narratives through the use of metaphors, visuals, and personal testimonies.¹⁷⁶ As Cox and Pezzullo note, environmental communication succeeds when it connects the rational with the emotional, allowing audiences to “feel” the stakes of crises.¹⁷⁷

The emotional weight of existential risks requires careful message design. Research informed by terror management theory shows that when people are reminded of death or catastrophic danger, they often react defensively.¹⁷⁸ Mortality reminders can heighten nationalism, prejudice, and conformity to in-group beliefs.¹⁷⁹ Survey experiments in the United States and Israel show that individuals exposed to mortality

167 Margaret Tucker and G. James Herrera, “Military Installations and Sea-Level Rise,” *Congressional Research Service*, July 26, 2019, <https://sgp.fas.org/crs/natsec/IF11275.pdf>.

168 *Ibid.*

169 Sterre van Buuren, Thomas Fraise, and Benoît Pelopidas, “Existential Silos: The Compartmentalization of the Futures of Environmental Change and the Nuclear Threat,” *Futures* 173 (2025), <https://doi.org/10.1016/j.futures.2025.103671>.

170 Caroline J. Charpentier et al., “Anxiety Increases Information-Seeking in Response to Large Changes,” *Scientific Reports* 12, no. 1 (2022), <https://doi.org/10.1038/s41598-022-10813-9>.

171 Stephen A. Bustin and Carl T. Wittwer, “Fragile Methods, Fractured Trust: Rethinking Scientific Responsibility,” *Methods* 242 (2025): 54–61, <https://doi.org/10.1016/j.ymeth.2025.07.003>.

172 Marcel Boumans et al., “Fostering Trustworthy Information: Countering Disinformation When There Are No Bare Facts,” *Royal Society Open Science* 12, no. 6 (2025), <https://doi.org/10.1098/rsos.250654>.

173 Peta Ashworth et al., “Developments in Public Communications on CCS,” *International Journal of Greenhouse Gas Control* 40 (2015): 449–58, <https://doi.org/10.1016/j.ijggc.2015.06.002>.

174 George Lakoff, “Why It Matters How We Frame the Environment,” *Environmental Communication* 4, no. 1 (2010): 70–81, <https://doi.org/10.1080/17524030903529749>; Matthew C. Nisbet, “Communicating Climate Change: Why Frames Matter for Public Engagement,” *Environment: Science and Policy for Sustainable Development* 51, no. 2 (2009): 12–23, <https://doi.org/10.3200/ENVT.51.2.12-23>.

175 Susanne Moser and Lisa Dilling, “Communicating Climate Change: Closing the Science–Action Gap,” in *The Oxford Handbook of Climate Change and Society*, eds. J. S. Dryzek, R. B. Norgaard, and D. Schlosberg (Oxford: Oxford University Press, 2011), 161–74.

176 Saffron O’Neill and Sophie Nicholson-Cole, “Fear Won’t Do It’: Promoting Positive Engagement with Climate Change through Visual and Iconic Representations,” *Science Communication* 30, no. 3 (2009): 355–79, <https://doi.org/10.1177/1075547008329201>.

177 Robert Cox and Phaedra C. Pezzullo, *Environmental Communication and the Public Sphere*, 4th ed. (Thousand Oaks, CA: SAGE Publications, 2016).

178 Jeff Greenberg, Tom Pyszczynski, and Sheldon Solomon, “The Causes and Consequences of a Need for Self-Esteem: A Terror Management Theory,” in *Public Self and Private Self*, ed. R. F. Baumeister (New York: Springer, 1986), 189–212.

179 Brian L. Burke, Spee Kosloff, and Mark J. Landau, “Death Goes to the Polls: A Meta-Analysis of Mortality Salience Effects on Political Attitudes,” *Political Psychology* 34, no. 2 (2013): 183–200, <https://doi.org/10.1111/pops.12005>.

salience become significantly more supportive of a nuclear first strike, despite expressing general aversion to nuclear weapons in baseline polling.¹⁸⁰ This finding underscores the risk that fear-based or apocalyptic messaging around nuclear threats may unintentionally weaken the nuclear taboo rather than mobilise support for restraint and disarmament.¹⁸¹

Environmental communication scholars further argue that communication shapes how societies perceive and value the world.¹⁸² Therefore, nuclear-climate discourse should incorporate a wider range of voices, especially the voices of communities and individuals worldwide who have suffered from radiation exposure due to nuclear disasters and testing – Global Hibakusha.¹⁸³

As Milstein and Mocatta show, expanding the discursive space to include historically marginalised perspectives is essential for building responses that are legitimate, context-aware, and grounded in global realities.¹⁸⁴ Integrating such perspectives grounds the discourse in lived experiences and creates an understanding of risk and responsibility.¹⁸⁵

Amplifying Engagement and Generating Empathy

Mass media and social media act as key vehicles for climate and nuclear narratives today. Singh notes that, on social media, pop culture accelerates engagement: hashtags, memes, and viral challenges create shared symbolic spaces that democratize participation and spread awareness rapidly.¹⁸⁶ Posting on popular social media platforms also amplifies outreach, enables rapid information dissemina-

tion, and fosters dialogue across borders.¹⁸⁷ At the same time, polarisation, misinformation, and algorithm-driven “clicktivism” threaten the quality and trustworthiness of information.¹⁸⁸

Immersive virtual reality (VR) is an innovative tool that creates a strong sense of presence that traditional media cannot match.¹⁸⁹ Across studies, VR consistently proves effective at translating climate awareness into meaningful action by engaging both cognitive and emotional dimensions of learning.¹⁹⁰ Research shows that VR experiences – such as 360° videos viewed through head-mounted displays – heighten users’ emotions, empathy, and connection to distant impacts, which in turn increases willingness to donate to and support climate initiatives.¹⁹¹ A recent VR storytelling about the Hiroshima nuclear attack lets users “experience” what one 12-year-old lived through 80 years ago in Hiroshima, based on a Hibakusha testimony.¹⁹² A news report documented students getting emotional over events that happened to people unrelated to them three generations ago.¹⁹³

Yet, traditional media are still significant. A tool to reach out to a wider audience is movies, especially Hollywood blockbusters.¹⁹⁴ Studies support that movies have a high educational value and that Hollywood blockbusters can stimulate public interest in formal science and in fact-checking.¹⁹⁵ Achugar and Baeza Duffy, with their analysis on youth reaction to movies about human rights violations, show that films operate as affective-semiotic catalysts that construct empathy, elevate issue salience, and accelerate the transition from emotional engagement to moral and action-oriented reflection.¹⁹⁶

180 Doreen Horschig, *An Illusional Nuclear Taboo: Mechanisms of Domestic Attitudinal Patterns for Extreme Methods of War* (PhD dissertation, University of Central Florida, 2021).

181 *Ibid.*

182 Tema Milstein and Gabi Mocatta, “Environmental Communication Theory and Practice for Global Transformation: An Ecocultural Approach,” in *Handbook of Global Interventions in Communication Theory*, ed. J. Yin and Y. Miike (London & New York: Routledge, 2022).

183 Sonali Huria, “Nuclear Bodies: *The Global Hibakusha*,” by Robert A. Jacobs,” *Journal for Peace and Nuclear Disarmament* 6, no. 2 (2023): 376–78, <https://doi.org/10.1080/25751654.2023.2286806>.

184 Milstein and Mocatta, “Environmental Communication Theory and Practice for Global Transformation.” *Op. Cit.*

185 *Ibid.*

186 Mudrit Kumar Singh, “Men Deny More Than They Believe About Climate Change on Twitter (X),” *PLoS ONE* 20, no. 2 (2025), <https://doi.org/10.1371/journal.pone.0303007>.

187 Aleksandrina V. Mavrodiya et al., “Role of Social Media as a Soft Power Tool in Raising Public Awareness and Engagement in Addressing Climate Change,” *Climate* 7, no. 10 (2019), <https://doi.org/10.3390/cli7100122>.

188 Apoorva Upadhyaya, Marco Fisichella, and Wolfgang Nejdil, “Towards Sentiment and Temporal Aided Stance Detection of Climate Change Tweets,” *Information Processing and Management* 60, no. 4 (2023), <https://doi.org/10.1016/j.ipm.2023.103325>.

189 Secil Tisoglu et al., “Bridging Pedagogy and Technology: A Systematic Review of Immersive Virtual Reality’s Potential in Climate Change Education,” *Environmental Education Research* (2025), <https://doi.org/10.1080/13504622.2025.2480661>.

190 *Ibid.*

191 Chloe Hurrell et al., “Virtual Reality Facilitates Pro-Environmental Behavioural Intentions,” *Environmental Education Research* 30, no. 10 (2024): 1856–883, <https://doi.org/10.1080/13504622.2024.2342942>.

192 “Using VR to Tell a Hibakusha’s Story,” *NHK World–Japan*, July 23, 2025, <https://www3.nhk.or.jp/nhkworld/en/news/ata glance/3440/>.

193 *Ibid.*

194 Kate Manzo, “The Usefulness of Climate Change Films,” *Geoforum* 84 (2017): 88–94, <https://doi.org/10.1016/j.geoforum.2017.06.006>.

195 Sidney Perkowitz, *Hollywood Science: Movies, Science and the End of the World* (New York: Columbia University Press, 2007).

196 Mariana Achugar and Patricia Baeza Duffy, “The Affective Construction of Others’ Experience: A Cross-Cultural Comparison of Youth’s Responses to a Film about the Uruguayan Dictatorship,” *Linguistics and Education* 66 (2021), <https://doi.org/10.1016/j.linged.2021.100993>.

Trusted Messengers – Key Communicators for Raising Awareness

Trusted messengers are especially vital to communicate such complex issues. According to the Boston University Institute for Global Sustainability, people are most likely to act on information delivered by credible, relatable figures – scientists, educators, doctors, community leaders, or peers – rather than distant authorities.¹⁹⁷ In nuclear-climate discourse, survivors of nuclear explosions from around the globe play a special role as messengers sharing their personal stories and living experiences in public talks, books, movies, etc.¹⁹⁸ Hibakusha, the survivors of the Hiroshima and Nagasaki atomic bombings, are unique trusted messengers when it comes to the threat of nuclear war, as they faced the consequences of nuclear attacks. As a high-level acknowledgement of the significance of Hibakusha as trusted messengers, the 2024 Nobel Peace Prize was awarded to Nihon Hidankyo, the organisation of Hiroshima and Nagasaki Hibakusha, for their contribution in establishing the global norm of the ‘nuclear taboo’.¹⁹⁹ Young people, including descendants of survivors, are powerful messengers of today, adopting new technologies²⁰⁰ and carrying on the messages of their ancestors.²⁰¹ A bright example of such heritage is Junpei Matsumoto, a third-generation atomic bomb survivor from Nagasaki and a director of the *Nagasaki: In the Shadow of the Flash* movie, which we discuss in more detail later in this paper.

SECTION 3

Communicating the Nexus: Japanese Hibakusha and Movie Narratives

Building on the communication challenges and tools identified above, this section examines Hibakusha testimony and film narratives as applied case studies. The analysis asks what these sources reveal about how complex existential risks are currently framed, where communication succeeds, and where conceptual fragmentation persists.

Hibakusha as Trusted Messengers

Communication theory emphasises the central role of trusted messengers in translating complex and emotionally charged risks into narratives that audiences perceive as legitimate and meaningful.²⁰² Japanese Hibakusha occupy a uniquely authoritative position as survivors of nuclear weapons use and long-term advocates for nuclear disarmament.

Hibakusha testimony exemplifies several foundations of effective communication identified earlier. First, it relies on storytelling rooted in lived experience, using personal narratives, visual art, music, and public speaking to make abstract threats tangible.²⁰³ Second, it provides a powerful form of temporal framing, emphasising that nuclear harm unfolds across decades and generations rather than ending at the moment of detonation.²⁰⁴ This long-term nuclear damage is clearly articulated in the 2024 Nobel Peace Prize Acceptance Speech delivered by Nihon Hidankyo’s representative Terumi Tanaka: “The damage inflicted on the A-bomb victims had impacted their lives, bodies, minds, and livelihoods. Their lives had been stolen, they had suffered physical and psychological scars, and had struggled to work due to illness and prejudice”.²⁰⁵ Third, Hibakusha narratives often conclude

197 Boston University Institute for Global Sustainability, “Climate Communications 101: The Trusted Messenger,” *Boston University*, April 16, 2019, <https://www.bu.edu/igs/2019/04/16/trusted-messenger/>.

198 “Using VR to Tell a Hibakusha’s Story.” *Op. Cit.*

199 Nobel Prize Outreach, “The Nobel Peace Prize 2024,” *The Nobel Prize*, October 11, 2024, <https://www.nobelprize.org/prizes/peace/2024/press-release/>.

200 “Using VR to Tell a Hibakusha’s Story.” *Op. Cit.*

201 Aigerim Seitenova, *JARA: Radioactive Patriarchy*, short documentary film, 2025, https://aigerimseitenova.com/jara_radioactivepatriarchy.

202 Boston University Institute for Global Sustainability, “Climate Communications 101.”

203 “Using VR to Tell a Hibakusha’s Story.” *Op. Cit.*

204 Masako Wada, “Eighty Years After the Atomic Bomb Attacks, My Mother’s Stories Still Haunt Me,” *Arms Control Association*, July/August 2025, <https://www.armscontrol.org/act/2025-07/features/eighty-years-after-atomic-bomb-attacks-my-mothers-stories-still-haunt-me>; Terumi Tanaka, “Nihon Hidankyo – Nobel Prize Lecture,” *The Nobel Prize*, December 10, 2024, <https://www.nobelprize.org/prizes/peace/2024/nihon-hidankyo/lecture/>.

205 Tanaka, “Nihon Hidankyo - Nobel Prize Lecture.” *Op. Cit.*

with action-oriented appeals, urging present-day audiences to prevent the repetition of past atrocities and to consider their responsibility to future generations. For example, this is echoed in the words of Ms. Masako Wada, a Hibakusha who has been serving as the Assistant Secretary-General of Nihon Hidankyo: “The Hibakusha are the ones who know the humanitarian consequences of the use of nuclear weapons. We will continue to convey that reality. Please listen to us, please empathise with us. Find out what you can do and take action together with us. Nuclear weapons cannot coexist with human beings. They were created by humans; let us assume the responsibility to abolish them with the wisdom of public conscience”.²⁰⁶

Jørgen Watne Frydnes, 2024 Chair of the Norwegian Nobel Committee, summarises the importance of such messages: “Their [Hibakusha’s] role in establishing the taboo is unique. Their personal stories humanise history, lifting the veil of forgetfulness and drawing us out of our daily routines. [...] They are living reminders of what is at stake.”²⁰⁷

These features align closely with the emphasis on framing risks through shared moral values²⁰⁸ and with the argument that effective environmental communication must connect rational understanding with emotional engagement.²⁰⁹ Hibakusha testimonies show how emotional resonance and moral authority can be achieved without triggering the defensive reactions associated with apocalyptic or fear-based messaging, a risk highlighted by terror management theory. However, for nexus communication, Hibakusha testimony would need to be complemented by accessible scientific framing that explicitly links the compound harm of nuclear weapons to broader environmental and climatic consequences without undermining the credibility and ethical weight that make Hibakusha trusted messengers in the first place.

Movie Narratives

In addition to personal testimonials from Hibakusha, we identify that pop culture, particularly movies, is a powerful communication tool as they can appeal to diverse target audiences. As discussed in the previous section, films can construct empathy, elevate issue salience, and accelerate the transi-

tion from emotional response to moral reflection. However, the analysis below shows that film narratives often reproduce the same fragmentation that hinders effective nuclear-climate communication.²¹⁰

Mainstream Western movies, or Hollywood blockbusters, tend to shy away from portraying what happened in Hiroshima and Nagasaki, including Hibakusha perspectives, beyond mentioning the atomic bombings or making subtle hints at their consequences.²¹¹

Nevertheless, some of these productions contribute to reinvigorating discussions surrounding nuclear weapons and responsibility. One such example is *Oppenheimer*, released in 2023. By portraying the emotional burden carried by those involved in developing the atomic bomb, *Oppenheimer* successfully humanised abstract technological risk and stimulated public discussion about the ethics of science. However, it merely mentions Hiroshima and Nagasaki, choosing to focus instead on the people behind the bomb rather than on its impacts. The film revived public discussion on nuclear responsibility,²¹² notably by focusing on the ethics of science, but missed the chance to connect with climate risks.

The film’s framing also illustrates a key limitation identified above. While emotionally compelling, *Oppenheimer* does not consider the health impacts on people downwind of the Nevada test site, the consequences of the Trinity test and 215 other atmospheric nuclear tests, as well as the long-lasting impact from the Hiroshima and Nagasaki atomic bombings.²¹³ From a communication-theory standpoint, the film demonstrates how audience emotional engagement can coexist with systemic omission of the nexus.

Other Western-produced films have included elements related to environmental degradation, radiation, or technological danger, but these references are typically fragmented and indirect. *The*

206 Wada, “Eighty Years After the Atomic Bomb Attacks.”; Tanaka, “Nihon Hidankyo.” *Op. Cit.*

207 Jørgen Watne Frydnes, “The Nobel Peace Prize 2024: Award Ceremony Speech,” *The Nobel Prize*, December 10, 2024, <https://www.nobelprize.org/prizes/peace/2024/ceremony-speech/>.

208 Lakoff, “Why it Matters How We Frame the Environment.” *Op. Cit.*

209 Cox and Pezzullo, *Environmental Communication and the Public Sphere*. *Op. Cit.*

210 Kjølv Egeland, “Disentangling the Nexus of Nuclear Weapons and Climate Change - A Research Agenda,” *International Studies Review* 27, no. 1 (2025), <https://doi.org/10.1093/isr/viaf003>.

211 Yuko Shibata, *Transnational Images of Hiroshima and Nagasaki: Knowledge Production and the Politics of Representation*, (Doctoral dissertation, Cornell University, 2009), <https://ecommons.cornell.edu/server/api/core/bitstreams/86ac5cb4-0eb6-4683-b165-98239519e176/content>.

212 Daryl G. Kimball, “Oppenheimer, the Bomb, and Arms Control—Then and Now,” *Bulletin of the Atomic Scientists*, July 19, 2023, <https://thebulletin.org/2023/07/oppenheimer-the-bomb-and-arms-control-then-and-now/>.

213 *Ibid.*

Manhattan Project hinted at radiation risks and fallout consequences, and framed nuclear weapons as a threat to future generations. Another example can be seen in *The Hunt for Red October*, which showcases the oceans as threatened ecosystems and relays anxiety about the safety of nuclear reactors, while also alerting to global climate risks from nuclear war.

In contrast, independently produced and Japanese films more consistently foreground humanitarian suffering and lived experience.²¹⁴

Films such as *Nagasaki: In the Shadow of the Flash* convey the immediate and long-term human consequences of atomic bombings through empathetic storytelling. As a human drama or war drama, it conveys the memoirs of nursing students of the Japanese Red Cross Society who provided aid to Hibakusha in the immediate aftermath of the bombing. Its empathetic message centres on the inhumanity of nuclear weapons and their human impacts. Here, the nuclear-climate nexus is implied in radiation leading to environmental degradation. The movie pushes viewers to reflect on renewed growing risks of nuclear weapons use, past trauma, current nuclear anxiety, and irreversible damage.²¹⁵ One example of an independently-produced film is *JARA - Radioactive Patriarchy: Women of Qazaqstan* by Aigerim Seitenova, which follows the stories of six women living in nuclear-affected Kazakh regions. This documentary unearths the tragic legacy of environmental destruction and human suffering caused by 40 years of nuclear testing on Kazakh land.²¹⁶ These narratives align closely with communication theory's emphasis on emotional engagement and moral witnessing, making the inhumanity and irreversibility of nuclear violence palpable to viewers. However, as with Hibakusha testimony, the environmental and climate dimensions of harm remain largely implicit. Radiation from nuclear explosions is presented as a source of illness and devastation, but is rarely explicitly connected to climate disruption or ecological collapse. These films succeed in building empathy and awareness while leaving the nuclear-climate nexus underdeveloped.

Synthesis: Applying Communication Theory to the Nexus Gap

Viewed through the lens of the communications theory, Hibakusha testimony and film narratives reveal a consistent pattern. Current communication practices somewhat succeed at humanising nuclear risk, generating empathy, and sustaining the nuclear taboo without provoking the defensive reactions associated with fear-based messaging. At the same time, they reproduce conceptual fragmentation by separating the humanitarian consequences of nuclear weapons from environmental and climate analysis. The case studies show that effective nexus communication cannot rely solely on emotional storytelling or trusted messengers, nor on just technical scientific explanation. Instead, it requires integrated framing that explicitly links lived experience, long-term harm, and Earth-system consequences in ways that are emotionally resonant, scientifically grounded, and action-oriented.

By highlighting both the strengths and limits of existing narratives, this section provides an empirical and theoretical bridge to the recommendations that follow. These lessons underscore the need for communication strategies that deliberately overcome fragmentation, expand the range of voices, and connect humanitarian and environmental risks into a cohesive nuclear-climate narrative.

214 Shibata, *Transnational Images of Hiroshima and Nagasaki*.

215 "Film Recalls Heroism of Nagasaki Nurses," *Beyond Nuclear*, August 4, 2025, <https://beyondnuclear.org/film-recalls-heroism-of-nagasaki-nurses/>.

216 Aigerim Seitenova, *JARA*. *Op. Cit.*

Recommendations

1. Expand the Discourse by Incorporating Environmental Impacts into Climate–Nuclear Analysis

Debates on the nuclear-climate nexus remain narrowly focused on nuclear winter²¹⁷ as the brightest showcase. A comprehensive approach must treat radiological contamination²¹⁸ and health impacts as integral components of global environmental change. Broadening the discourse in this way highlights how nuclear and climate risks overlap geographically and socially, especially in vulnerable regions.

As an example of adopting such an approach, talking about the humanitarian consequences of nuclear weapons can include climate consequences as well, as damaged ecology impacts human health. There could be a more explicit coverage of environmental damage in production based on Hibakusha testimonies, e.g., the movies analysed above.

In particular, experts in nuclear weapons and climate change should take on the task of exploring the nexus further,²¹⁹ and communication theorists should produce insights that can be taken on further by advocates.

2. Strengthen Framing, Storytelling, and Public Narratives

Communicating the nuclear-climate nexus requires narrative techniques that make risks relatable. The use of innovative tools in communication, such as VR, the power of social media, and movies, needs to adopt approaches that combine scientific evidence with human stories, particularly those of Hibakusha and communities affected by nuclear testing or climate disasters. Metaphors and framing tools that link distant or abstract risks to familiar experiences, as well as immersive formats, further enhance comprehension.²²⁰

3. Empower Affected Communities and Youth as Trusted Messengers

People are more likely to act on information delivered by figures who possess credibility and/or relatable experiences.²²¹ Training educators, survivors, medical workers, scientists, young people, and local community leaders as communicators can bridge gaps between expert knowledge and public understanding. Such capacity-building fosters a more diverse ecosystem of trusted voices.

At the same time, youth-led digital storytelling on platforms such as TikTok, Instagram, YouTube, and using VR can reach wider audiences. Co-producing social media campaigns and other forms of communication materials with the Global Hibakusha would strengthen the message. Preserving and translating testimonies from Hibakusha and nuclear-testing survivors ensures that affected communities remain central to public and political dialogue.

4. Build Multi-Stakeholder Platforms for Sustained Dialogue

Long-term communication on the climate–nuclear nexus requires institutionalised platforms that connect governments, United Nations (UN) agencies, civil society, private actors, and scientific communities. Such platforms can integrate nuclear-risk information into climate apps, educational portals, and disaster-preparedness systems, making nexus awareness part of everyday public engagement. To be effective, these platforms should be guided by clear leadership, a defined mandate, and shared methodologies to ensure coherence of messaging and prevent fragmentation.

Multi-stakeholder campaigns that combine scientific expertise with youth and civil society perspectives can help align national climate-security narratives with broader disaster risk reduction strategies. Streamlined and coordinated processes would be essential for managing diverse perspectives without harming scientific credibility. These platforms would not only support coherent and coordinated communication but also cultivate sustained dialogue and public resilience.

217 Tilman A. Ruff, "The Climate Effects of Nuclear War," *Medicine, Conflict and Survival* (2025), <https://doi.org/10.1080/13623699.2025.2560274>.

218 Právělie, "Nuclear Weapons Tests and Environmental Consequences." *Op. Cit.*

219 Egeland, *Disentangling the Nexus of Nuclear Weapons and Climate Change*. *Op. Cit.*

220 Sam White et al., "Climate, Peace, and Conflict—Past and Present: Bridging Insights from Historical Sciences and Contemporary Research," *Ambio* 54 (2025): 774–92, <https://doi.org/10.1007/s13280-024-02109-1>.

221 Boston University Institute for Global Sustainability, "Climate Communications 101." *Op. Cit.*

Conclusion

The nuclear-climate nexus is a twin existential threat: nuclear weapons testing and use drive long-term climatic and environmental disruption, while climate change undermines the safety of nuclear infrastructure. Treating these risks separately obscures how they reinforce each other. Scientific research shows that even a “limited” nuclear exchange could trigger a nuclear winter, while climate impacts such as heatwaves, droughts, sea-level rise, and extreme storms increase the vulnerability of civilian nuclear facilities and military installations.

Communicating this nexus is therefore essential but remains constrained by conceptual fragmentation and technical complexity. Communication theory highlights that effective engagement requires clear framing, emotionally resonant storytelling, transparency, and partnership with the public. Expanding perspectives anchors the discourse in lived experience and brings visibility to the harms stemming from the nuclear-climate nexus.

Hibakusha testimonies are particularly powerful in this regard: they convey intergenerational trauma, long-term health impacts such as chronic illnesses, cancers, psychological harm, and the irreversibility of nuclear harm, concluding with calls to action which link present political and policy choices to future generations. Just as Hibakusha are recognised as trusted messengers, this role also applies to young people because they have a stake in this matter as inheritors of this planet, and they have demonstrated their capacity in translating intricate risks into more accessible narratives through climate activism, for example.

While mainstream cinema has the potential to extend the aforementioned framings to wider audiences, it has so far done so unevenly. For instance, while Hollywood blockbusters such as *Oppenheimer* have revived nuclear responsibility debates, they have omitted Hibakusha perspectives and climatic consequences. In contrast, Japanese and independent films like *Nagasaki - In the Shadow of the Flash* and *JARA - Radioactive Patriarchy* have emphasised humanitarian and environmental consequences, yet the climate dimensions of nuclear harm remain underdeveloped across most cinematic narratives.



Ultimately, how the nuclear-climate nexus is communicated will have a determinative effect on the emergence of political will. Abstract framing sustains political and policy inertia, whereas narratives that stress climate vulnerability, health impacts, and intergenerational responsibility mobilise policymakers.

This has been historically proven through Hibakusha testimonies informing humanitarian disarmament and youth activism, reshaping climate policy agendas.

By further specifying the nuclear-climate nexus, making it more tangible, imbuing it with a sense of urgency and stressing its social relevance, communication can transform concern into sustained public pressure that fosters the necessary political conditions to prevent irreversible climate and nuclear harm to people and the planet.

About the Participants

Working Group 1

Sathchidha Pachiappan

Sathchidha Pachiappan is a Research Consultant and International Security Advisor at Challenger Research and a 2026 Fellow of the Training in Radiological and International Security (TRAINS) Project under the OECD Nuclear Energy Agency (NEA) NEST Fellowship Programme. Her work focuses on interdisciplinary nuclear crisis management, supported by a background in international security politics, nuclear safeguards, and human rights. She holds a Master's degree in International Security Politics from Université Catholique de Lille, France, and a Specialising Master's in Nuclear Safeguards from Politecnico di Milano, Italy, as a SaTe Fellow.

Kudakwashe Mapako

Kudakwashe is an Inter-disciplinary Researcher in Law and Policy, Arms Control Negotiation Academy Fellow (ACONA), External Consultant for the Verification, Research, Training and Information Centre (VERTIC) supporting the African Research and Innovation Hub for Nuclear Disarmament Verification Project. He holds a Master of Laws Degree specializing in International Law from the University of Cape Town, South Africa, and a Bachelor of Laws Degree (LLB) Major in International Law (Cum Laude) from Zhejiang Gongshang University, China.

Morgan Slessor

Morgan Slessor is a researcher based in Vancouver, Canada. He has an MA in Political Science from the University of Waterloo. His research focused on the intersection between nuclear proliferation and emerging technology, specifically 3D printing. He was also a Summer Fellows Program in Nuclear Nonproliferation Education and Research Centre (NEREC) at Korea Advanced Institute of Science and Technology (KAIST). He has been a member of the Emerging Voices Network for the last five years.

Kokoro Nishiyama

Kokoro is a PhD student in Global Humanities and Social Sciences at Nagasaki University and a Visiting Researcher at the Research Center for Nuclear Weapons Abolition (RECNA). Born in Fukuoka, she moved to Nagasaki during junior high school to study nuclear weapons issues. She later earned her MA in Nonproliferation and Terrorism Studies from the Middlebury Institute of International Studies at Monterey. She has worked as a research intern at the Vienna Center for Disarmament and Non-Proliferation (VCDNP) and served as a mentor for the UN Office for Disarmament Affairs Youth for Disarmament (UNODA Y4D) initiative.

Kosei Yamashita

Kosei is a junior in the Faculty of Economics at Nagasaki University, and completed the CDAST Course on Disarmament and Non-Proliferation organised by Japan Institute of International Affairs last summer. Born and raised in Nagasaki, he has an interest in peace and security, and is currently exploring new approaches to disarmament and non-proliferation education that focus on responsibility and complexity.

Kazuki Noda

Kazuki is a senior in the School of Global Humanities and Social Sciences at Nagasaki University, originally from Fukuoka, Japan. Majoring in international relations, his research focuses on the intersection of nuclear governance and emerging technologies, specifically examining the role of human oversight and accountability in the deployment of autonomous systems. By living and studying in Nagasaki, he is deeply committed to learning from the city's history and the experiences of Hibakusha to contribute to the global dialogue on nuclear disarmament.

Working Group 2

Franco Castro Escobar

Franco is a PhD candidate at Keele University studying youth antinuclear activism. Franco belongs to the David Bruce Centre for the study of the Americas (2026), the University of Glasgow's Atomic Anxiety in the New Nuclear Age Fellowship Scheme (2025), the Hiroshima Peace Institute Fellowship (2024), and the UN Youth Leader Fund for World Without Nuclear Weapons (2024).

Yerdaulet Rakhmatulla

Yerdaulet is the Founder & CEO of JASA, a youth-led social venture tackling AI and other existential risks in Central Asia and worldwide, and Founding Director of Operations & Communications of the ASQAQ-QNFC, an intergenerational alliance of nuclear justice advocates. Since 2021, he has advanced peace with Nobel Laureates, including Hihon Hidankyo, and other stakeholders via transnational solidarity-building tours, national law reform and TPNW implementation advocacy, and Track 1.5-2 diplomacy.

Hazel Ropafadzo Ruzani

As a Medical Physics graduate from the University of Zimbabwe, Hazel has witnessed its life-saving potential in the daily fight against cancer. While she champions these medical advancements, she remains a vigilant voice against the global threats posed by nuclear technology in the wrong hands. Her mission is to ensure that the science of healing is always protected by rigorous policy and ethical safeguards. Hazel stands at the intersection of innovation and security, dedicated to a future where radiation serves only the betterment of humanity.

Nina VanderVeen

Nina is a second-year medical student at Nagasaki University School of Medicine. With a German father and a Japanese mother, she is the granddaughter of two atomic bomb survivors on her maternal side. Drawing on her academic background in medicine, she is particularly focused on studying the effects of radiation on the human body and applying this expertise to her peace advocacy. Since high school, she has been actively engaged in peace-related activities and was awarded first place in a national speech competition for her advocacy on nuclear disarmament. She is also a member of the 13th Nagasaki Youth Delegation.

Kazushi Akizuki

Kazushi is a student at Nagasaki University, from Aichi prefecture, which is far from Nagasaki, so while he had never experienced peace study before, he is determined to work hard on this project. As a Japanese person, he believes young generations have an important role in passing on the experience and message from hibakusha to future generations and achieving world peace.

Working Group 3

Galina Salnikova

Galina works as a Youth Engagement Coordinator at the UN RCO in Viet Nam. Previously, she served as a consultant on research and education at the UN Office for Disarmament Affairs (UNODA), where she developed the curriculum for Youth4Disarmament 2nd edition and contributed to the start of the Youth Leaders Fund for a World Without Nuclear Weapons. Galina holds an M.A. in International Relations and an M.A. in Non-Proliferation of Weapons of Mass Destruction & Global Security from MGIMO University in Russia and Middlebury Institute of International Studies at Monterey, USA. Galina was recognised as a Youth Communicator for a World Without Nuclear Weapons by the Japanese MFA in 2016.

Christelle Barakat

Christelle is a Researcher on public policies at the Lebanese Center for Policy Studies and an incoming Schwarzman Scholar. She is also an Emerging Expert with the Forum on the Arms Trade, an Atomic Anxiety in the New Nuclear Age Fellow, an advisory board member with BASIC EVN, and a mentor in the second cohort of the Youth Leaders' Fund for a World Without Nuclear Weapons. Over the years, she was selected as a Youth Leader for a World Without Nuclear Weapons (first cohort), Leader to the Future, Leader for Tomorrow, and Youth Champion for Disarmament (first cohort) with the United Nations Office for Disarmament Affairs (UNODA).

Emily Day

Emily is an experienced researcher, writer, and editor with expertise in geopolitics, nuclear energy, and global security. She is the Associate Editor of Energy World and Techland at the National Interest and a Senior Research Associate at Longview Global Advisors, where she provides insights on global political and economic trends with a specialization in utilities, risk, sustainability, and technology. Emily holds a Master of Science in International Security from the Georgia Institute of Technology.

Hikari Katsuki

Hikari is originally from Nagasaki and is a second-year student in the Faculty of Economics, majoring in the International Business track within the Economics program at Nagasaki University. As a member of the 13th Nagasaki Youth Delegation, she has learned about the global framework for the abolition of nuclear weapons and each country's view on nuclear weapons. Through this project, she would like to learn more about the issue of nuclear weapons in relation to her field of specialization. Her grandmother's brother was an atomic bomb survivor.

Waka Kuwahara

Waka is a third-year student in the Faculty of Environmental Science. She is particularly interested in the connection between nuclear weapons and environmental issues. Waka has lived abroad, and during that time, she discovered that many people from other countries are deeply interested in the history of Nagasaki and Hiroshima. She believes it is important to share this history not only within Japan but also with the rest of the world, in order to contribute to global peace for future generations. She hopes to continue learning and taking action to help carry this message forward.

Editorial Team

Dave Cullen

Dave is a Policy Fellow and Programme Manager of the Emerging Voices Network (EVN) at BASIC. Prior to BASIC, he was the Director for the Nuclear Information Service (NIS). He is an expert on the UK nuclear weapons programme and his work focuses on the interrelationship between technology, policy and politics in relation to weapon systems and disarmament. Dave is also co-chair of the Office for Nuclear Regulation's NGO forum and chair of trustees at the Conflict and Environment Observatory.

Chiara Cervasio

Dr. Chiara Cervasio is a Senior Policy Fellow and Programme Manager of the Responsibilities and Global Governance Programme at BASIC. Her expertise includes nuclear diplomacy, trust-building practices, nuclear risk reduction, and crisis management and de-escalation practices. Chiara's research focuses on security dynamics between nuclear-armed states in the Asia-Pacific, especially India-China and India-Pakistan relations, as well as Arctic security dynamics.

Kazuko Hikawa

Dr. Kazuko Hikawa currently serves as the Vice Director of and professor at the Research Center for Nuclear Weapons Abolition (RECNA) at Nagasaki University in Japan. She is also an Adjunct Fellow of the Japan Institute of International Affairs and Co-Founder of World New Prosperity. Prior to her academic career, she served as a diplomat with the Japanese Foreign Service for 24 years. From 2021 to 2023, Kazuko was a member of the UN Group of Governmental Experts on Nuclear Disarmament Verification. During this time, she contributed to the adoption of a report to the UN Secretary General by consensus.

Declan Penrose

Declan is a Policy Fellow and Programme Officer in the Emerging Voices Network at BASIC. Previously, he was the Online Coordinator at Youth for TPNW and part of their policy team. Declan holds a BA in Human Geography and International Politics, and an MA in International Politics from Aberystwyth University. He is currently doing a PhD at the University of Manchester where he analyses the affective economies of the nuclear disarmament movement. He was a 2024 Ploughshares and Horizon 2045 Nuclear Futures Fellow and is part of the 2026 cohort of the University of Glasgow's Atomic Anxieties Fellowship.

Chiara Fargnoli

Chiara is a policy intern in the Emerging Voices Network programme at BASIC. Prior to BASIC, Chiara was a research associate at the Belfer Center at Managing the Atom, where she focused on missile defense in the European theater. She completed her Master's degree at the Fletcher School-Tufts University in International Negotiation, Conflict Resolution, and Emerging Technologies, and holds a mediation certificate from the Harvard Mediation Programme.

Mentors

Michiru Nishida

Dr. Michiru Nishida is a Professor at the School of Global Humanities and Social Sciences and Deputy Director of the Research Center for Global Risk (CGR) at Nagasaki University, as well as a Senior Research Adviser at Asia Pacific Leadership Network (APLN). He specialises in arms control, disarmament, and non-proliferation. He has worked for many years in the field of arms control, disarmament and non-proliferation as a diplomat and as a Special Advisor for Arms Control, Disarmament and Non-Proliferation at the Ministry of Foreign Affairs of Japan. He holds an M.A. in International Policy Studies with a certificate on nonproliferation from Middlebury Institute of International Studies at Monterey, and Ph.D. in Laws from Hitotsubashi University. Michiru served as the mentor for Working Group 1.

Kazuko Hikawa

Dr. Kazuko Hiwaka served as the mentor for Working Group 2.

Jaroslav Krasny

Dr. Jaroslav Krasny is a professor at Nagasaki University, Research Center for Nuclear Weapons Abolition (RECNA). Previously, he worked as a researcher at the United Nations Institute for Disarmament Research (UNIDIR) in the Weapons of Mass Destruction Programme. Also, he held a research associate position at Hiroshima University, Center for Peace and for several years worked with the Ministry of Interior of the Czech Republic, focusing on WMD non-proliferation and arms control measures. His research covers the law of armed conflict, weapons law, the law of targeting, arms control, and disarmament. Jaroslav holds a Ph.D. in Development Studies from Hiroshima University and a master's degree in international law in armed conflict from the Geneva Academy of International Humanitarian Law and Human Rights. Jaroslav served as the mentor for Working Group 3.

List of Acronyms

AI	Artificial Intelligence	NC3	Nuclear Command, Control, and Communications
C2	Command and Control	NNWS	Non-Nuclear Weapon States
EDTs	Emerging and Disruptive Technologies	NPT	Treaty on the Non-Proliferation of Nuclear Weapons
ERR	Excess Relative Risk	NWS	Nuclear Weapon States
GAI	Generative Artificial Intelligence	MHC	Meaningful Human Control
Gy	1 Gray of Radiation	OPCW	Organisation for the Prohibition of Chemical Weapons
IAEA	International Atomic Energy Agency	REAIM	Responsible AI in the Military Domain
ICBMs	InterContinental Ballistic Missiles	TPNW	Treaty on the Prohibition of Nuclear Weapons
ISR	Intelligence, Surveillance, and Reconnaissance	UN	United Nations
LAWS	Lethal Autonomous Weapons Systems	UNIDIR	United Nations Institute for Disarmament Research
MIRVs	Multiple Independently-targetable Reentry Vehicles	UNODA	United Nations Office for Disarmament Affairs
MIPs	Model Intercomparison Projects	VR	Virtual Reality
N5	Five Nuclear-Weapon States	WACCM4	Whole Atmosphere Community Climate Model v4

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
