



WEBINAR REPORT

Climate Change and National Defence

November 16th, 2023

ABOUT THE WEBINAR

Webinar: “[Climate Change and National Defense](#)”.
Held on November 16, 2023.
Available at the Sovereignty and Climate Center’s
YouTube channel.

The event is part of the Webinar Series “Climate, Sustainability, and Defence”, held in partnership with the NETZMIL Project (Loughborough University, United Kingdom) and the Training Center on Defence Economics and Force Development (NCAD/ESD).

Participants’ Bios



Richard Nugee is a British Army General with extensive experience leading operational teams, having served in both the Army and the British government, on the Defence Executive Committee in Personnel Leadership. His recent work includes a comprehensive report focusing on strategy and planning regarding Defence and Climate Change, encompassing the implications for national security, defence, and international partners. As a result, he currently holds an advisory position as a Non-Executive Director for the Climate Change agenda at the British Ministry of Defence.



Sergio Etchegoyen is a retired Army General. He served as the Chief Minister of the Institutional Security Cabinet of the Presidency of the Republic (from May 2016 to December 2018). He joined the Army in 1971 at the Agulhas Negras Military Academy. As a general officer (from November 2004 to May 2016), he commanded the 4th Mechanised Cavalry Brigade, the Army Command and General Staff College (ECEME), served as a military special advisor to the Minister of Defence, and concurrently served as head of the National Defence Strategy Implementation Unit. He is a co-founder of Sovereignty and Climate.



Duncan Depledge completed his Ph.D. at Royal Holloway, University of London, a Master’s in Geographical Research at the University of Cambridge, a Master’s in Political Theory, and a Bachelor’s in History at the University of Sheffield. As the Chief Researcher of the NETZMIL Project, a professor at Loughborough University, and the author of the book ‘Britain and the Arctic’ (2018), he is an associated researcher at RUSI, a visiting researcher at the British Navy’s Centre for Strategic Studies,

a senior researcher for the ‘Climate Change and (In) Security’ project, a partnership between the University of Oxford and the British Army, and a member of the advisory board for the British parliamentary multiparty group for the polar regions.



Tamiris Santos holds post-doctoral and doctoral degrees in International Strategic Studies from UFRGS, both part of projects funded by CAPES in conjunction with the Brazilian Ministry of Defence. She is an associate researcher at the NETZMIL Project and at Loughborough University, with publications on defence management, joint military operations, interoperability, and military innovation. In Brazil, she works as a guest researcher in the Procad ASTROS project and in the Research Network on Security and Defence Studies (REPESD), and in the UK, she collaborates with the Military Innovation Network, an inter-institutional research network based at the King’s College London Centre for Science and Security Studies (CSSS).



Peterson Ferreira da Silva Peterson Ferreira da Silva has been a Federal Higher Education Professor at the Brazilian Defence College (ESD) since 2018. He holds a Ph.D. from the Institute of International Relations at the University of São Paulo (IRI-USP). He is a Public Management specialist from the School of Sociology and Politics of São Paulo Foundation. He was an associated researcher at the Army Strategic Studies Center from 2016 to 2018. Since 2020, he has been coordinating the Defence Economics and Force Development Unit (NCAD) at ESD. His areas of interest include public policies and national security, national defence policies and reforms, and the defence industry.

Introduction¹

The increasingly frequent occurrence of environmental catastrophes, characterising the new reality imposed by the climate crisis, shows two orders of action inherent to any government planning today. The first concerns the need for adaptation, in which strategies to deal with the inevitable consequences of climate change prevail, aiming to minimise damage, protect vulnerable communities and promote resilience in the face of the impacts of these catastrophes. The second order of action refers to mitigation, with actions that are capable of drastically reducing the emission of greenhouse gases in the atmosphere, implemented in several areas, including energy, transport, industry, agriculture, land use, among others.

Given the problem presented, the idea that such actions should be exclusive to state structures related to environmental areas limits governmental action. It also significantly affects practical actions transforming national structures, a necessary movement to deal with the complexity of the climate emergency in a global context.

In this perspective, the Sovereignty and Climate Center, in partnership with the Brazilian Defence College and Loughborough University, with the support of the Climate and Society Institute and the Brazilian Association of Defence and Security Materials Industries, aims to bring to light a discussion about the role of national defence in the face of the need to address these issues, emphasising the urgency of an energy transition within the armed forces, in addition to the protection of civil society in the face of climate disasters.

Thus, the debate proposed in the first meeting of the Cycle of Webinars on Climate, Sustainability and Defence entitled “Climate Change and National Defence” is not intended to bring definitive answers to a complex and multifaceted problem. Instead, it can be understood as a first step to offer comprehensive background and different perspectives, highlighting an overview that serves as a starting point for understanding the challenges and opportunities for the national defence area in Brazil, observing how other countries, notably the United Kingdom, face the challenges arising from the climate emergency and the lessons learned in the process.

This report is structured in three parts, aiming to comprehensively understand the discussions held. The first part presents a picture of the main ideas discussed during the event, outlining the key themes that permeated the conversations. The second part focused on detailing the discussions of the first round, highlighting the problems identified and exploring possible ways to solve these issues. The third part focuses on the discussions of the second round, taking up some of the main ideas previously discussed and explicitly addressing the issues punctuated by the audience present. Finally, the conclusion summarises the discussions, providing an integrated view of the topics addressed throughout the event and consolidating the main conclusions reached.

1. In this text, to facilitate understanding, the capitalised term “Armed Forces” refers to the set of the three Singular Forces in Brazil (Brazilian Navy, Brazilian Army, and Brazilian Air Force). In lowercase, the term “armed forces” refers to the different variations of these internationally verified institutions.

Strategic recommendations derived from the webinar discussions.

	General Richard Nugee	General Sergio Etchegoyen	Dr. Duncan Depledge	Dr. Tamiris Santos
RECOMMENDATIONS	<ul style="list-style-type: none"> Integrate climate change response into defence strategies, recognising the direct implications on military operations. Provide specific armed forces training for humanitarian and disaster relief missions in response to climate change. 	<ul style="list-style-type: none"> Develop an updated military doctrine, considering climate change and its implications for military operations in several regions of Brazil. Invest in technologies that allow the adaptation of military equipment to climate change, ensuring operational effectiveness in adverse conditions. 	<ul style="list-style-type: none"> Adopt a holistic approach that simultaneously considers reducing emissions, technological opportunities, and maintaining operational effectiveness. Integrate climate considerations into military strategy, recognising the influence of climate change on operations and global security. 	<ul style="list-style-type: none"> Adopt a holistic approach encompassing emission reduction, technological opportunities, operational efficiency, and integration of research efforts. Develop a responsive strategy to promote technological advancement and simultaneously reduce emissions from the military industry, resulting from an operational effort coordinated with scientific research. Strengthen the integration of research efforts between civil, military, and industrial institutions, aiming at innovative solutions to specific challenges.
OPPORTUNITIES	<ul style="list-style-type: none"> Increase military self-sufficiency by reducing supply chains and investing in renewable energy sources. Tactical and strategic innovations arising from climate change, promoting greater operational efficiency. 	<ul style="list-style-type: none"> The Armed Forces in Brazil must play a key role in supporting Civil Defence in the face of natural disasters due to their mobility, logistics and ability to stay in relief actions. This skill represents a valuable opportunity for Brazil not only in natural crisis management but also in promoting cooperation and assistance in emergencies to partner countries. 	<ul style="list-style-type: none"> Find solutions that, by adapting military equipment, result in reduced emissions, thus addressing two challenges simultaneously. The transformation of the defence industry towards creating sustainable low-carbon innovations offers the opportunity to address two challenges simultaneously: reducing emissions and adapting armed forces to the new climate crisis scenario. Integrate the fourth industrial revolution with automation and artificial intelligence, considering the pressures of climate change and the demands of society. 	<ul style="list-style-type: none"> Collaboration between government entities, NGOs, academic institutions and the private sector, aiming at sustainable innovations. Brazil could take a leading position, especially in developing clean energy technologies and integrating innovative research in defence. In addition, the Defence Ministry has a great capacity to train personnel to work directly on mitigation projects, which can be a “bargaining chip” in international cooperation for Brazil to obtain the technology necessary to adapt the Armed Forces of Brazil to this new scenario.

Keywords

Decarbonisation; Defence Strategies; Climate Change; Energy Transition.



WEBINAR REPORT

Climate Change and National Defence

1. Details of the First Round of Discussions

“How did defence start to take climate change seriously?”, the rhetorical question in which General Richard Nugee began his reflection, points to a problem not only in the United Kingdom but also in Brazil, crucially stressing that adoption of a national climate agenda that must act beyond the boundaries of environmental areas. That is, how could one convince policymakers in national defence that the climate agenda is essential nowadays?

General Richard Nugee highlighted the changing perspective in the British defence sector. He pointed out that initially, there was scepticism about the relevance of climate change to military operations. Now, there is a growing recognition that the response to these changes is not only an environmental stance but also a strategy to increase operational advantage and military power against adversaries.

In his analysis, transformations in the physical environment, such as the rapid melting of the Arctic and changes in sea conditions, directly impact military operations. In this sense, he cites how different Navies may need a fast adaptation in their operating model due to the rising sea levels. In addition, he highlighted the increased need for the armed forces to handle humanitarian and disaster relief missions on their own territory due to changing weather patterns and extreme events.

In the Brazilian perspective on national defence and climate, General Sergio Etchegoyen emphasised the complexity of the relationship between climate change and military adaptation, especially considering Brazil’s geographical and climatic diversity. He highlighted that the Brazilian Armed Forces face unique challenges due to the variety of climates in the country, spread over several latitudes. The General stressed the importance of updating military doctrine and defensive strategies to address geographic and climate change, demonstrating the need for an adaptive approach.

Reflecting on how to balance the interest in military decarbonisation with the need for the military to continue to fulfil its main tasks, Dr. Duncan Depledge presented a perspective on sustainability in military activities and the challenges of climate change, detailing the “Net Zero Militaries” project that aims to assess the actual and potential impact of the UK government’s Net Zero ambitions on military operations. He outlined three pillars of the project: understanding the problem, exploring technological opportunities and challenges, and inserting these considerations into the broader context of the future of war. He highlighted the pursuit of mitigating emissions while maintaining operational effectiveness, demonstrating a holistic approach to transitioning to a low-carbon defence. A crucial point of Dr. Depledge’s speech is that maintaining dependence on fossil fuels will become progressively more costly for both the Armed Forces and the Defence Industry.

“When we think about the different pressures that climate change is creating on defence, we are all very familiar with thinking about climate change as a driver of conflict, a potential driver of conflict in the future. And I think that defense organisations are beginning to see that there is also an adaptation question here. That defence will have to think about how its people and its equipment are going to be able to maintain their operational capability, their operational outputs, in increasingly extreme and volatile environmental conditions. It’s

going to be much harder to predict from one season to the next, from one year to the next. And that's particularly significant for conflicts and operations that last over longer periods. What environment are you actually going to be confronted with ahead of time? You could be lurching from extreme heat to extremely wet conditions, for example.”

Seeking connection with all the points presented and considering the reality of Brazil, Dr. Tamiris Santos discussed the energy transition in the Brazilian context, highlighting the importance of considering energy not only as an asset but as a finite capacity. She stressed the need to consider the operational efficiency of the different armed forces around the globe in various scenarios, considering significant implications in terms of force design, doctrine, organisation, resource management and planning. Dr. Santos emphasised the importance of integrating military and civilian institutions' technological and research efforts as an opportunity to decarbonise defence forces.

“In this scenario of energy transition and concern about climate change, we face not only challenges but also countless opportunities. In this context of opportunity, we may need to keep a close eye, especially in the Brazilian case, due to clean energy research, including studies on biodiesel and other initiatives developed by civil and military institutions.”

2. Identified Problems and Ways to Resolve Disagreements

We previously noted some initial points considered by the panellists about the climate change agenda and sustainability in the area of national defence. The analyses presented address identified challenges that provoke a profound reflection on the ways necessary to solve such divergences as follows.

2.1. PERCEPTION OF CLIMATE CHANGE AND INTEGRATION OF THE RESPONSE IN THE STRATEGY OF DEFENCE

General Richard Nugee highlights, as the first challenge, the need to overcome the initial scepticism in the defence sector regarding the relevance of climate change to military operations. He emphasises the importance of understanding that the response to these changes goes beyond an environmental issue and is also strategic to strengthen defence capabilities. The difficulty lies in effectively communicating that climate change directly impacts military operations, going beyond the scope traditionally associated with environmental issues.

In light of this challenge, the proposed solution is to integrate the response to climate change into defence strategies. Acknowledging the direct implications on military operations, the following recommendation aims to overcome initial scepticism and promote a broader understanding of how climate change may impact security and defence capabilities. By incorporating this climate perspective, the military can readily adapt to environmental challenges whilst strengthening its resilience and operational effectiveness in an ever-evolving global environment.

CHALLENGE	APPROACH	RECOMMENDATION
Overcome scepticism in the defence sector with the relevance of climate change for military operations.	A need to communicate that the answer is not just an environmental issue but a strategy to strengthen defence capabilities.	Integrate the answer to climate change in defence strategies, recognising the direct impacts on military operations.

2.2. OPERATIONAL PRIORITIES AMID CLIMATE CHANGE: TRAINING AND PREPARATION FOR HUMANITARIAN MISSIONS

When it comes to challenges about how militaries around the globe should adjust their operational priorities in response to climate change and extreme events, General Richard Nugee stresses, taking the British case as an example, that “We are being called upon more often to react because we are a uniformed and disciplined body of personnel who can help our systems.” Exemplified by this argument, the General pointed out how the Australian Army, over the last three years, has been called up to fight the COVID-19 Pandemic, act against fires and floods, and how their forces were in danger because they have not been trained to face such situations.

The primary approach identified by Nugee is to train the armed forces in general to act efficiently in the face of environmental disasters, ensuring effectiveness in protecting civil society. Faced with this challenge, the suggestion presented is clear: to invest in specific training and preparation of the armed forces for humanitarian and relief missions in response to climate change. This approach not only empowers forces to deal with complex and unpredictable scenarios but also strengthens the response of military institutions to the emerging challenges associated with climate change, contributing to the security and well-being of civil society.

In sum:

CHALLENGE	APPROACH	SUGGESTIONS
About how the armed forces must adjust their operations priorities in response to climate change and extreme events.	Training of the armed forces to act in the face of environmental disasters in an efficient way that ensures effectiveness in protecting civil society.	Specific training of the armed forces for humanitarian missions and disaster relief in response to climate change.

2.3. PERCEPTION OF THE RELEVANCE OF CLIMATE CHANGE IN DEFENCE STRATEGIES: DEVELOPMENT OF UPDATED DOCTRINE

Considering the complexity and diversity of Brazil, there is a challenge regarding the urgency and depth with which climate change should integrate guiding documents of national defence in Brazil. According to General Sergio Etchegoyen, Brazil is geographically diverse and hosts a variety of biomes; this assortment offers numerous perspectives to address the issue of climate change in the context of Brazilian national defence. There is a need for an update of doctrine, which will inevitably result in the modification of equipment and performance of the Armed Forces in Brazil. However, a new doctrine focusing on tackling climate change will also face additional pressures from geographic and biome variations in areas where the Armed Forces already perform specific functions.

“Imagine the different climates we have daily in Brazil, the different regions, and what this diversity can bring to the Armed Forces’ mission, which aims to defend the Homeland. Considering the constitutional mission assigned to the Brazilian Armed Forces and the guidelines of our foreign policy, we have a wide variety of perspectives on how to address the issue of climate change for the defence system and how these changes will impact the Armed Forces in Brazil.”

For example, the General pointed out the implications of the climate emergency in regions where the three Forces already operate, such as jungle troops in the Amazon. Climate change will substantially impact logistics, requiring adaptations to deal with the new conditions. Thus, perspectives involve a variety of paths that open up, whether in the field of logistics, equipment, doctrine or in the preparation of the human being, especially the soldier who will face different circumstances.

Thus, in short:

CHALLENGE	APPROACH	SUGGESTION
As for urgency and depth at which climate change should be integrated into the defence strategies, considering the complexity and diversity of Brazil.	Achieve a consensus on the immediate importance of climate change in defence strategies and the need for adaptation.	Develop an updated military doctrine, considering climate change and its implications for the military in every region of Brazil.

2.4. PRIORITIES IN MILITARY ADAPTATION: INVESTMENT IN ADAPTIVE TECHNOLOGIES

In the face of climate change and its varied repercussions in different regions of the country, challenges arise regarding priorities in military adaptation. “A series of paths open up: logistics, equipment, doctrine and preparation of the human being, especially the soldier who will be fighting in different circumstances”, as General Sergio Etchegoyen argues.

In this topic, establishing clear priorities becomes imperative, as different perspectives influence the definition of what is considered most crucial in the adaptation process. Thus, there is a need to balance immediate effectiveness, technological development, and logistics to face adverse weather conditions while strengthening the role of the Armed Forces in Brazil in supporting Civil Defense in the face of extreme weather events.

For General Etchegoyen, one solution to address these challenges is to direct investments toward adaptive technologies that can face extreme conditions. The suggestion is to invest in innovations that efficiently adapt military equipment to climate change, ensuring operational effectiveness even in adverse conditions. By prioritising developing and implementing technologies that consider the country’s climate diversity, the Armed Forces can position themselves more robustly to face future challenges. This proactive approach ensures operational readiness while establishing a solid foundation to address climate change’s dynamic and unpredictable impacts on military operations. In his words:

“In addition, the Armed Forces in Brazil play an essential role in supporting Civil Defense in the face of natural disasters. No other institution in the country has the necessary mobility, logistics, and presence to deal with major catastrophes. At this moment, we realise the urgency of changes in the defence structure to adapt to the present and the future, especially in the face of ongoing conflicts in Europe and the Middle East. The lack of adaptation to climate change in these scenarios highlights the need for immediate action to avoid larger impacts.”

CHALLENGE	APPROACH	SUGGESTION
About priorities in military adaptation to climate change, including the operational effectiveness technological opportunities and the future implications.	Establish clear priorities that effectively address climate changes, considering the different perspectives on what is more crucial.	Invest in technologies that allow the adaptation of military equipment to climate changes, ensuring operational effectiveness in adverse conditions.

2.5. PRIORITIES IN MILITARY ADAPTATION: A HOLISTIC APPROACH

According to Dr. Duncan Depledge, facing the current challenges related to the need to reduce greenhouse gas emissions in the activities of the Armed Forces while maintaining operational effectiveness in the face of constantly evolving demands and climate change, represents a complex dilemma. The convergence between environmental responsibility and the strategic need to preserve the strategic performance of the defence highlights the urgency of an innovative and holistic approach. In this context, the proposal of an integrated approach that simultaneously considers emission reduction, technological opportunities and maintenance of operational effectiveness emerges as a promising solution.

The opportunity to achieve a win-win approach is revealed by adapting military equipment to cope with both extreme weather conditions and future cost savings for equipment maintenance using fossil fuels. In this topic, not only is the response capacity of the Armed Forces strengthened, but it also contributes significantly to reducing greenhouse gas emissions. This synergy between operational efficiency and environmental sustainability meets contemporary requirements whilst preparing the military for future challenges. Achieving an effective harmonisation between national security objectives and environmental imperatives is possible by adopting innovative technologies and eco-efficient strategies, transforming challenges into opportunities for a more resilient and sustainable future.

CHALLENGES	APPROACH	OPPORTUNITY
There is a need to reduce greenhouse gas emissions in the performance of the Armed Forces and the importance of maintaining operational effectiveness, considering the evolving demands and climate change.	A holistic approach considering reducing emissions, technological opportunities, and maintaining operational effectiveness.	Opportunity to achieve a win-win approach, adapting military equipment to face extreme conditions while reducing greenhouse gas emissions.

2.6. ADAPTING MILITARY INDUSTRY TO CLIMATE CHANGE:
A HOLISTIC APPROACH TO THE FOURTH INDUSTRIAL REVOLUTION

The challenges faced by the different armed forces in the face of increasingly extreme and volatile environmental conditions generate divergences on the best approach to maintain operability in long-term operations. The complexity of this scenario demands a strategic reassessment, and a crucial approach is to consider climate change as an integral part of discussions about the Fourth Industrial Revolution. This entails recognising the implications of climate change on how the military operates, highlighting the need for adaptation to meet emerging challenges.

In the words of Dr. Depledge,

“While everyone else is talking about how artificial intelligence, automation and additive manufacturing, all the technologies we associate with the so-called fourth Industrial Revolution are going to bring about quite profound changes in how military operates, no one is situating that against the fact that this will all be happening during a period of intense climate breakdown and growing societal demands for action to address that.”

In this challenging context, a significant opportunity arises for the military to lead the transition to more sustainable energy sources. By exploring this possibility, military institutions align with global shifts toward renewables and demonstrate an innovative commitment to sustainability. The search for cleaner energy sources contributes to mitigating environmental impacts and strengthens the armed forces’ operational resilience in the face of climate adversity. Thus, the opportunity to lead this transition addresses immediate challenges and positions the armed forces as proactive agents in building a more sustainable and climate-ready future.

CHALLENGE	APPROACH	OPPORTUNITY
Divergences on how the armed forces must adapt to maintain operability in increasingly extreme and volatile environmental conditions, predicting impacts on long-term operations.	Consider climate change an integral part of discussions about the Fourth Industrial Revolution and its implications for the armed forces’ operations.	Explore the possibility for the armed forces to lead the transition to more sustainable energy sources in line with global shifts toward renewables.

2.7. PERSPECTIVES ON ENERGY TRANSITION: HOLISTIC APPROACH TO MILITARY ADAPTATION

Dr. Tamiris Santos highlighted the challenges and opportunities presented to the Brazilian Armed Forces regarding the energy transition. The core of this problem lies in the need to adapt military structures and operations to a new energy paradigm while simultaneously dealing with the complexities inherent in this process.

The approach proposed by Dr. Santos reinforces the importance of a holistic view, and her recommendation goes beyond operational efficiency, covering organisational planning and resource allocation implications. This comprehensive approach ensures that the energy transition integrates existing structures cohesively, maximising benefits and minimising obstacles.

Regarding opportunities, Dr. Santos highlights the importance of addressing the issue of energy security. This involves analysing the vulnerability of distributed power generation and promoting the integration of efforts to avoid redundancies. By identifying and capitalising on these opportunities, the Brazilian Armed Forces move toward a more sustainable energy model and strengthen their responsiveness and resilience in the face of contemporary and future challenges.

CHALLENGE	APPROACH	OPPORTUNITY
Regarding the approach to the energy transition in the military context, including specific challenges and opportunities for the Brazilian Armed Forces.	Recommendation for a holistic approach that considers operational efficiency, organisational planning, and resource implications when addressing the energy transition.	Highlight the opportunity to address the issue of energy security, including the vulnerability of distributed power generation and the integration of efforts to avoid redundancies.

2.8. ENERGY TRANSITION APPROACH: POTENTIAL IN CLEAN ENERGY RESEARCH

The debate proposed by Dr. Tamiris Santos revolves around integrating research and innovation efforts, both in civilian and military institutions, in order to address the challenges related to energy security and the transition to cleaner sources. This issue underscores the importance of an integrated approach that brings together knowledge and resources from different sectors to address energy challenges efficiently.

“We need to integrate more efforts to avoid redundancies, which has been worked on at the Ministry of Defense, integrating technological and research efforts of military and civilian institutions. In this energy transition context and concern about climate change, we face not only challenges but also many opportunities.”

Considering this challenge, Dr. Santos presents a concrete proposal: to strengthen the integration of research efforts between civilian and military institutions, aiming at innovative solutions to overcome specific challenges on the way to the energy transition. This approach seeks not only to overcome the divergences between the civilian and the military but also to promote a synergy that capitalises on the expertise of each sector. By fostering closer and more targeted collaboration, it is possible to create an enabling environment for developing technologies and strategies to drive the transition to cleaner energy sources, thereby strengthening energy security comprehensively.

CHALLENGE	APPROACH	OPPORTUNITY
The integration of research and innovation, both in civilian and military institutions, to face the challenges related to energy security and the transition to cleaner sources.	Strengthen the means to enable integration of research efforts between the civil and the military institutions and industries, aiming at innovative solutions for Brazil's specific challenges.	Strengthen the research on clean energy. Explore opportunities in research on Clean Energy, biodiesel and other initiatives that can benefit both the Armed Forces and Brazilian society.

3. Opportunities for Defense

The insights offered by experts General Richard Nugee, General Sergio Etchegoyen, Dr. Duncan Depledge and Dr. Tamiris Santos, provide a comprehensive and strategic view of the opportunities emerging in the military scenario in the face of climate change. General Nugee highlights the relevance of self-sufficiency and operational resilience, identifying the opportunity for the Armed Forces to play a key role in supporting Civil Defense during natural disasters. General Etchegoyen, on the other hand, highlights the opportunity for learning and global adaptation of the Armed Forces to climate change, with a special focus on international integration and lessons learned. Dr. Depledge highlights crucial opportunities in technological adaptation and emission reduction, proposing solutions that simultaneously address operational and environmental challenges. Finally, Dr. Santos identifies collaboration for innovation as a key opportunity, positioning Brazil as a leader in areas such as developing clean energy technologies and integrating innovative research in the military sector, highlighting strategic opportunities for international cooperation. These perspectives intertwine to form a rich scenario of opportunities ranging from strengthening operational capacities to global leadership in the context of climate change. These points are presented in greater detail below:

3.1. OPERATIONAL SELF-SUFFICIENCY AND RESILIENCE AND TACTICAL AND STRATEGIC INNOVATION

General Richard Nugee highlights significant opportunities in the military context, focusing on self-sufficiency and operational resilience as milestones. The opportunity identified is to increase military self-sufficiency by reducing supply chains and investing in renewable energy sources. By minimising reliance on extensive logistics chains, the Armed Forces can strengthen their ability to operate autonomously and effectively, especially in crisis response situations. Investing in renewable energy sources contributes to environmental sustainability and increases operational resilience by ensuring a reliable energy source in diverse scenarios.

Another opportunity identified by General Nugee stands out in the exploration of tactical and strategic innovations arising from adaptation to climate change. These opportunities have the potential to promote greater operational efficiency, allowing the military to adapt to emerging challenges dynamically. By embracing tactical and strategic innovations, the military can improve its ability to respond to extreme weather events and position itself more effectively in an ever-evolving operational environment. This approach demonstrates Nugee's forward-looking vision by identifying opportunities within the challenges of climate change, shedding light on the importance of innovation for military resilience and efficiency.

3.2. ROLE OF THE ARMED FORCES IN SUPPORT OF CIVIL DEFENSE: INTERNATIONAL ADAPTATION AND LESSONS LEARNED

General Sergio Etchegoyen highlights valuable opportunities for the Armed Forces, emphasising their key role in supporting civil defence during natural disasters. The opportunity identified lies in the unique capacity of the Armed Forces in Brazil to offer mobility, efficient logistics and sustained relief efforts, essential characteristics for a rapid and effective response in emergencies. In recognising and highlighting the Armed Forces' potential in this context, Etchegoyen highlights a strategic opportunity to strengthen collaboration between the military and civilian sectors, ensuring a more robust and coordinated response in the face of natural disasters.

Another opportunity pointed out by General Etchegoyen is related to international adaptation and lessons learned in the context of climate change. Considering how the Armed Forces can adapt globally to these changes recognises the interconnected nature of climate challenges but also highlights the importance of a collaborative approach internationally. The opportunity for global learning and adaptation positions the Brazilian Armed Forces as proactive agents in the search for effective solutions in an increasingly complex and globalised climate change context. This perspective reflects a strategic and collaborative approach to addressing the present and future challenges associated with climate change.

3.3. TECHNOLOGY ADAPTATION AND EMISSION REDUCTION: A CONNECTION BETWEEN THE FOURTH INDUSTRIAL REVOLUTION AND CLIMATE CHANGE

Dr. Duncan Depledge highlights strategic opportunities by identifying the possibility of finding solutions that, by adapting military equipment, also result in reduced emissions. This opportunity represents an innovative approach, simultaneously addressing two crucial challenges: the need to modernise military equipment to address climate change and the urgency to reduce emissions to combat global warming. By emphasising the interconnectedness of these challenges, Depledge suggests an integrated approach that strengthens military readiness whilst contributing to broader environmental goals.

Another opportunity Dr. Depledge highlighted is exploring the connections between the Fourth Industrial Revolution, characterised by automation and artificial intelligence, and climate change. Considering environmental pressures and societal demands, this approach suggests significant opportunities to integrate advanced technologies into the military's response to climate change. By incorporating these technologies, the search for efficiency, sustainability, and innovation can result in more effective and adaptable solutions to the challenging dynamics imposed by climate change, exemplifying a strategic vision to face the challenges of the 21st century.

3.4. COLLABORATIONS FOR INNOVATION: A LEADERSHIP OPPORTUNITY FOR BRAZIL

Dr. Tamiris Santos identifies strategic opportunities by emphasising the importance of collaboration between government entities, NGOs, academic institutions, and the private sector, aiming at sustainable innovations. This opportunity highlights the relevance of multifaceted partnerships to drive innovative solutions in the face of the challenges presented by climate change. By highlighting the need for collaboration between different sectors of society, Santos points to the possibility of synergies that can result in significant advances in developing and implementing sustainable technologies and strategies.

Another opportunity Dr. Santos highlights is the potential to position Brazil as a leader in specific areas, especially in developing clean energy technologies and integrating innovative research in the military sector. In addition, Santos emphasises the significant capacity of the Brazilian Ministry of Defense in training personnel for mitigation projects, which can serve as a bargaining chip in international cooperation. This strategic positioning reinforces Brazil's influence in global climate discussions. It offers concrete opportunities for the country to obtain essential technologies for adapting the Armed Forces to the new climate scenario while promoting international cooperation and domestic training.

4. Details of the Second Round of Discussions

The second round of discussion at the event brought a more focused dynamics, focusing on the specific issues presented to the panellists. This more interactive format allowed a more in-depth exploration of the opportunities identified by the experts, opening space for more detailed insights into practical implementation strategies. The following highlights the points raised by each panellist.

4.1. GENERAL RICHARD NUGEE

In the second round of discussion, General Richard Nugee answered specific questions about how the U.K. has been integrating climate change and sustainability into its defence strategy. He provided a detailed overview of this process, thoroughly addressing emissions from various military activities. The highlight was the careful assessment of emissions from buildings, military training and operations of vehicles, ships, and aircraft, emphasising the complexity of defence operations in environmental terms.

The problem identified by Nugee was the significant contribution of defence to the UK central government's total emissions, accounting for around 51%. This scenario creates consid-

erable challenges to aligning military operations with broader government goals, especially in the face of legislation requiring carbon neutrality by 2050.

General Nugee emphasised that the government imposes policies and regulations that apply to everyone, including the United Kingdom's Armed Forces. In his argument, he noted that despite the Armed Forces having specific responsibilities related to national defence, these units remain subordinate to the government and must collaborate in reducing emissions to achieve the carbon neutrality target by 2050, as stipulated by law. The objective is to ensure that the government achieves this goal, recognising that each sector plays a fundamental role in reducing emissions to combat climate change. And the Ministry of Defence is also part of this effort. However, the general highlighted that the government made concessions for defence operations in times of war: "The government has made no concession to our peacetime forces but has made concessions to our military operational forces. If we're going to war, it's not the same".

To resolve these disagreements, General Nugee emphasised the need for a continued commitment to reducing emissions. He stressed that the Armed Forces must align their operations with government policies and carbon neutrality goals, recognising the crucial importance of national defence actions to the overall success of these initiatives.

In addition, Nugee identified a significant opportunity in integrating military operations into global climate goals. He emphasised that the commitment to achieve carbon neutrality by 2050 is not only an obligation, but an opportunity for the Armed Forces to lead environmental initiatives. Such an opportunity involves adopting more sustainable technologies, exploring renewable energy sources, and collaborating with government and civil entities to achieve common emission reduction goals.

Regarding Brazil, General Nugee pointed out that the transformation of defence to embrace carbon neutrality is an opportunity because it is a peaceful country that emphasises exercises rather than going to war at this time. In his words:

"It is very clear that Defence needs to offer its services, in terms of its planning capability in terms of people to governments, to help them understand what is going on. And, potentially, although it would vary country by country, that soft skills, that planning skill, that resilience-building skills, and that skill on understanding what adaptation is needed maybe will value to other countries that are not so resilient or not so skilled in their own way. And just perhaps we can support other countries, whether they ask for support, with those skills, so that the military is not going with weapons but going with skills, techniques, and procedures to try to help other countries overcome the problems of climate change and become more resilient themselves. I'm saying that there's a piece of government, there's a piece at, if you like, ambassadors for trying to improve resilience across the world. And I think, because we are good at planning, we're good at understanding the factors that go into these circumstances, we can help others, and I think that's a really important place to try to get to".

4.2. GENERAL SERGIO ETCHEGOYEN

Sergio Etchegoyen, when answering questions about the importance of the climate change and sustainability agenda for Brazilian defence, provided a comprehensive analysis of the complexities faced by the Armed Forces concerning these issues. He highlighted the track record of the Brazilian defence industry, noting its current challenges in terms of diversification and technology. Etchegoyen emphasised that despite Brazil being one of the largest emitters of greenhouse gases, the country's share is relatively small compared to other more polluting nations, underscoring the importance of assessing the global context.

The main problem identified by General Etchegoyen was the complexity and diversity of the issues faced by Brazil, from the need to modernise military equipment to the contradictions between environmental pressures and broader international security challenges. Among

those, he stressed the need for more clarity in the international scenario and the uncertainties about advancing solutions to the environmental issue.

As for means to resolve disagreements, Etchegoyen indicated the need for a careful and balanced approach, emphasising the importance of not compromising Brazil's defence and operational capacity by quickly adhering to environmental solutions. Considering the international context and geopolitical pressures, a suggested way to balance environmental needs with security demands was searching for a global approach.

The opportunity highlighted by the General was the need for Brazil to cooperate globally without harming its defence capacity. He emphasised the importance of analysing opportunities and challenges realistically, acknowledging Brazil's role as a peaceful country in South America. Observing international dynamics and searching for solutions adapted to the national context were pointed out as opportunities to face the identified challenges.

4.3. DR. DUNCAN DEPLEDGE

Dr. Duncan Depledge addressed the complexity of balancing the need to adapt military doctrines, concepts, and capabilities to the demands of a world in transition to a new low-carbon scenario while maintaining operational readiness and effectiveness. He highlighted three main observations:

1. Decarbonisation as an Opportunity, not Just a Task: Dr. Depledge proposes a change of mindset, highlighting that decarbonisation should not be seen only as a task to be accomplished but as an opportunity instead. He argues that this process can facilitate future defence activities, enabling military operations in a world characterised by low carbon emissions.

2. Costs of Staying on the Current Path: Depledge draws attention to the lack of discussions about the costs associated with staying on the current path. He hints at an emerging trend to consider that the long-term costs of decarbonisation may be lower than the ongoing costs associated with using fossil fuels. This analysis covers the financial aspects and implications of structural and conceptual changes in military operations.

3. Decarbonisation as a Societal Challenge, not Exclusively Military: He stresses that decarbonisation transcends the military scope, being a challenge that permeates the entire society. It raises a fundamental question about the purpose of the military in defence. Additionally, it suggests the need to explore other organisations and structures to address security issues rather than relying exclusively on the Armed Forces. Such an issue highlights the societal nature of decarbonisation, not restricting this consideration to the military domain.

In short, his observations highlight the dilemma of balancing adaptation to decarbonisation with the associated costs, covering both financial aspects and structural and conceptual transformations in military operations.

4.4. DR. TAMIRIS SANTOS

Dr. Tamiris Santos addressed the complexity associated with the decarbonisation of the Armed Forces in the Brazilian context, drawing pertinent comparisons with the reality of the United Kingdom.

During her second analysis, Dr. Santos reinforced two crucial issues:

1. Urgent Need to Separate Costs: She stressed the importance of a clear separation of costs related to the transition to a decarbonised defence. She emphasised that this process cannot be treated as an exclusive decision of defence institutions but rather as a topic that demands a broad debate and societal participation. The division of costs must be equitable and effective, with a fair involvement of various sectors of society.

2. Lack of Integration between defence and other governmental spheres: Resuming her argument in the first moment of the webinar, Dr. Santos highlights the lack of integration between defence and other governmental spheres in Brazil, both in terms of solutions and planning. This lack of coordination significantly hinders effective planning, especially when adopting a capability-based methodology, which requires synergy among different departments. Inadequate integration affects the Armed Forces, the civilian sector, and other government sectors, demanding a more holistic approach to implementing decarbonising strategies.

The opportunity highlighted involves leveraging existing science, technology, and innovation (STI) capabilities in both civilian and military institutions. By integrating these capabilities, Brazil can create a synergy that addresses defence decarbonisation whilst benefiting from opportunities for innovation and existing clean technologies in the country. Such a movement would reduce late adaptation costs and promote Brazil's leadership in this context.

5. Conclusion

The in-depth analysis of the perspectives presented by the experts — General Richard Nugee, General Sergio Etchegoyen, Dr. Duncan Depledge and Dr. Tamiris Santos — reveals a complex and challenging scenario concerning climate change integration into the defence strategies of the United Kingdom and Brazil. Each speaker brought valuable inputs, highlighting the importance of aligning military operations with Net Zero goals and the need for a mindset shift towards decarbonisation.

The problems identified, such as the perception of climate change in defence, divergences in the relevance of these changes in strategies, priorities in military adaptation and perspectives on the energy transition, reflect significant barriers that require innovative and cooperative approaches. The opportunities identified, such as operational self-sufficiency, the role of the Armed Forces in supporting civil defence and the integration of research and innovations, offer promising paths to overcome these hindrances.

Recommendations suggest the need for continued commitment, development of updated doctrines, holistic approaches to military adaptation, specific training, investment in adaptive technologies, and an effective integration of research efforts. In addition, they highlight the importance of a careful, balanced, and global approach in the search for solutions, acknowledging the complexity of environmental issues amid international security challenges. International cooperation is also recommended as an instrument for the Armed Forces, promoting synergies between Brazil's partner nations to tackle environmental and security challenges, strengthening collaboration, sharing resources and exchanging knowledge to achieve sustainable and global solutions.

In a nutshell, the discussions provided a comprehensive view of the intersections between climate change and defence strategies, indicating that, despite significant obstacles to overcome, there are invaluable opportunities to improve operational effectiveness, promote sustainability, and leverage both Brazil and the United Kingdom as champions of change in an ever-changing world. ■

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