Military Emissions Gap Conference 2023

MILITARY AND CONFLICT GHG EMISSIONS:
FROM UNDERSTANDING TO MITIGATION

Tuesday 26 September, University of Oxford, and online
Will militaries decarbonise?
NATO Secretary General Jens Stoltenberg (2021)

“there is no way to reach net zero without also including emissions from the military…We cannot choose between either green or strong armed forces, we need strong and green at the same time. But I’m absolutely confident that in the future, the most effective, the best planes, the best ships, the best military vehicles, they will be fuelled by something different than fossil fuels. They will not emit”.
Pathways to decarbonisation (The 4Rs)

Refuel
Repower
Redirect
Review
Net Zero Militaries (NETZMIL): Retaining Operational Effectiveness in a Low Carbon World

Lead Research Organisation: Loughborough University
Department Name: Politics and International Studies

Abstract
Defence is the single largest institutional consumer of hydrocarbons in the world. In the UK, the defence sector accounts for approximately 50% of central government greenhouse gas emissions. In 2021, responding to growing pressure from civil society and defence industry, both the UK Ministry of Defence (MoD) and NATO recognised that the carbon cost of military operations needed to fall. However, academics and policymakers have yet to meaningfully address the implications of Net Zero ambitions for the future character of military operations.

NETZMIL aims to assess the actual and potential impact of the UK Government’s Net Zero ambitions on military operations. The project has been co-designed through consultations with key stakeholders from across UK Defence and NATO. Using the UK as a case study, NETZMIL will illuminate key concerns, challenges and opportunities around how militaries in general can retain operational effectiveness whilst supporting the transition to a Net Zero world.

www.net-zero-military.org
THANK YOU
Dr Duncan Depledge
d.depledge@lboro.ac.uk
@DMDepledge
Connect on LinkedIn

[https://doi.org/10.1093/ia/iiad001](https://doi.org/10.1093/ia/iiad001).

[https://doi.org/10.1038/s41558-023-01763-9](https://doi.org/10.1038/s41558-023-01763-9)
Military Emissions Gap Conference 2023

MILITARY AND CONFLICT GHG EMISSIONS: FROM UNDERSTANDING TO MITIGATION

Tuesday 26 September, University of Oxford, and online
SAFE LANDING: Aviation Worker
Perspective on Aviation Greenwash

Finlay Asher
AGENDA

• My background
• My organisation: Safe Landing
• Issues with aviation decarbonisation plans
• How this relates to defence
Finlay Asher
• Mechanical / Aerospace Engineer
• Co-founder of Safe Landing (aviation workers)
• 8 Years @ Rolls-Royce: Future Aircraft Engine Design
My Background: Future Concepts

"Future Programmes" = 2030-2040

"UltraFan"

"Variable Pitch Fan"
• LinkedIn: https://www.linkedin.com/company/safe-landing-org/

• Twitter: https://twitter.com/_SafeLanding

• Facebook: https://www.facebook.com/safe.landing.workers

• Instagram: https://www.instagram.com/safe_landing/
Our Demands

As aviation workers, we demand that our leaders:

1. **Be honest** about the total environmental impact of flying
2. **Be realistic** about the limits of technology to solve this problem
3. **Be transparent** about future regulations required to reduce emissions
4. **Have a plan** that accounts for this and supports workers during transition
Our positions:

As aviation workers, we believe that:

1. Flying has a high environmental impact, and is currently highly inequitable.

2. Technology will not be available at scale in the time required (10-15 years).

3. Future regulations are vital, and this includes limiting air traffic.

4. Acknowledging this, and planning for this, is in all of our best interests.
STRATEGIC SECURITY RISKS

1. Harnessing artificial intelligence
2. An expanding competitive space
3. Increasing proliferation of weapons of mass effect
4. Erosion of state sovereignty
5. Adaptation of the rules-based international system
6. An expanded and unregulated information space
7. Rising inequality, reducing social cohesion, and fragmented societies
8. Understanding human enhancement
9. Increasing competition in the global commons
10. Increasing disruption and cost of climate change
11. Increasing demand and competition for resources
12. Greater automation and an increasingly diverse workforce
13. Managing technological change
14. The challenge of affordability
15. Increasing threat from crime and extremism
16. Managing demographic change

- The climate is changing and will have major consequences for humanity. The impacts of climate change need to be mitigated effectively, otherwise it could act as a driver of instability and conflict with far-reaching humanitarian, economic and geopolitical consequences.

- Systems to mitigate food and water scarcity and disruptions to supplies need to be developed to avoid shortages and prevent instability.

Source: UK MoD, 2018
2 KEY APPROACHES:

Risk Mitigation

• Consider all potential scenarios and threats.
• Prepare for the worst, don’t assume the best.
• Have multiple mitigation options, in case any fail.

Systems Thinking

• Perform robust requirements capture.
• Consider interactions with other systems.
• Consider changing requirements with time.
Requirement 1:
CARBON BUDGET / TIME
Time:

We have very limited time before we blow our carbon budget for 1.5\textdegree C.

SOURCES:
Stanford University
Time:
We have very limited time before we blow our carbon budget for 1.5degC.

SOURCE:
Stanford University
THIS IS AN EMERGENCY
Requirement 2:
LOW-CARBON ENERGY RESOURCE / BUDGET
Biofuels for net-zero aviation ‘could require half of UK agricultural land’

Source:
Royal Society, 2023

Source:
S. Becken et al, 2023
Requirement 3:

PRICE OF CARBON / EMISSIONS
Carbon Price Comparison: BEIS Values vs. Jet Zero 'ETS'

(Internal-EU Flights)

Not Modelled!
Carbon Price Comparison: BEIS Values vs. Jet Zero 'CORSIA'

(International Flights)

Not Modelled!
Comparison: BEIS Carbon Values vs. Jet Zero 'ETS' and 'CORSIA' Prices
Our industry is on a dangerous trajectory: we need to set a new flightpath
Sustainable Aviation: the industry uses a "sustainability play book" to justify future growth.
How big is the problem?

This also ignores aviation’s Non-CO2 emissions

SOURCES:
1. Rolls-Royce
2. CarbonBrief
How big is the problem?

Aviation’s CO$_2$ emissions are just the tip of the iceberg.

Aviation's total climate impact is 3x that of CO$_2$ emissions alone.

SOURCES:
D.S. Lee et al., 2020
Sustainable Aviation: The 4 Pillars
Efficiency Improvements

“Zero Emissions” Aircraft

“Sustainable” Aviation Fuels

Carbon Offsetting
Aircraft Efficiency
Historical aircraft efficiency improvements have led to total emissions increasing, not decreasing. This will continue into the future unless air traffic is constrained.

SOURCE: Stay Grounded
Aircraft Efficiency

- Historical aircraft efficiency improvements have led to total emissions increasing, not decreasing.
- This will continue into the future – unless air traffic growth is constrained.

SOURCE: Stay Grounded
Electric Flight

*accounting for improved efficiency of electric motor vs. thermal engine

\[1 \text{ kg of fuel} = 25 \text{ kg of batteries}^*\]

... only viable for small aircraft, flying very short distances

... ground transport (trains, coaches, ferries) are a more efficient use of green electricity

SOURCE: Stay Grounded
eVTOL = electric Vertical Take-Off & Landing

Very inefficient = even shorter range and payload capabilities.

SOURCE: Joby Aviation S4
Hydrogen Flight
Hydrogen requires 4x the volume of Jet Fuel
... to store the same amount of energy.
Either:

- Increased aircraft size – increasing drag and weight:

- Identical aircraft size, but reduced numbers of passengers:

SOURCE: Stay Grounded
Hydrogen Flight

... likely viable for medium aircraft, flying medium distances

... will take 15-20 years to develop & certify first aircraft

Requires very different aircraft, airports – and huge amounts of energy
Alternative Jet Fuel

“Sustainable Aviation Fuels”
Alternative Jet Fuel

“Sustainable Aviation Fuels”
Biofuels
Alternative Jet Fuel

Biofuels

The danger of ‘fuel-from-crops’ biofuels

Fossil diesel 1.0x
Rapeseed 1.2x
Soy 2x
Palm 3x
Biodiesel average 1.8x

Sources: Transport & Environment

Transport & Environment

Globiom forecasts these biodiesels will account for 57% of the total EU biofuels market in 2020.
Source: Lifecycle analysis by T&E based on Globiom study (2016)
The danger of ‘fuel-from-crops’ biofuels

Producing food for other people’s planes:
A case study on the Omega Green biofuel refinery in Paraguay

The Paraguayan Chaco suffers one of the highest deforestation rates in the world, losing around 800 hectares per day.

By 2020 about 40% of the natural forest cover had been lost, and it is estimated that in 10 years about 70% of the forest will be gone.

SOURCES:
Stay Grounded
Can ‘fuel-from-waste’ biofuels scale?
Can ‘fuel-from-waste’ biofuels scale?

**Competing uses:**
- Non-fossil fuel fertiliser
- Heating and industry
- Bioenergy Carbon Capture & Storage
- Road transport fuels
- Shipping fuels
- Bioplastics

**Lack of cross-sector analysis and prioritisation of resource**

**Sources:** Transport & Environment
Very likely we’ll need to reserve all our sustainable biomass waste for fertiliser and Bioenergy with Carbon Capture & Storage (BECCS)

**Figure 5.1: Potential global demand for sustainable biomass by key end-use applications in 2050**

**Biomass Supply**

**Biomass Use**

**Sources:** Climate Change Committee
Alternative Jet Fuel
Electro-fuels
“E-fuels”

Renewable Power

Carbon Capture
e.g. “Direct Air Capture”
(or “Industrial Carbon Capture”)

Non-CO₂ emissions not re-captured.

Water

Hydrogen

CO₂

E-fuel

Aircraft

Electrolysis

Synthesis

H₂O

Electricity

SOURCE:
Stay Grounded
100% Synthetic E-fuel Calculations

UK civil aviation emissions in 2018 = 38.2 Mt\(\text{CO}_2\) [source, page 6]

1kg fuel = 3.15kg \(\text{CO}_2\) [source, page 17]

12,100,000 tonnes jet fuel x 12,000 kWh/tonne = \(~145\) TWh of jet fuel

100% E-fuel: 145 TWh of jet fuel supplied from e-fuel (@ 45% efficiency) requires 323 TWh of electricity.

UK electricity demand in 2020 was 330 TWh [source], but only:
- 135 TWh was from ‘renewables’ (includes bioenergy)
- 97 TWh from wind/wave/solar/hydro combined (excludes bioenergy)
- 75 TWh from wind
- 50-60 TWh from nuclear

So: 100% e-fuel requires either:
- a similar quantity of energy to the entire UK electricity generation today (mostly non-renewables)
- > 3x current renewable generation (wind, wave, solar and hydro power)
- > 4x current wind energy generation
Alternative Jet Fuel
Synthetic Electrofuels
“Synfuels”
“E-fuels”
“Power – to – Liquid”
Alternative Jet Fuel

E-Fuels

Offshore wind farm area required to produce enough e-fuel to replace 100% of current UK jet fuel use. (~14,500km² = circle of 135km diameter)

Source: calcs on slide above

Source: Crown Estate
We have a finite supply of renewable energy available and this is far less than current global energy consumption (see figure).

The difference is provided by burning fossil fuels.

It’s very important that most green electricity produced isn’t wasted through inefficient activities, e.g.: flying and ‘e-fuel’ production.

“Got a long way to go!”
Energy Efficiency of Transport Activities

- Renewable Power: 100% Renewable Electricity
- Charge Electric Vehicle (EV): Charging → Motoring
- Drive Electric Vehicle (EV): Motoring → Electrolysis
- Produce Hydrogen [Gas]: H2 gas + Liquefaction
- Produce Hydrogen [Liquid]: H2 gas + DAC + FT Synthesis
- Produce E-kerosene [Jet Fuel]: LH2 Production
- Fly H2 [Combustor] Aircraft: Combustion → LH2 Production
- Fly E-kerosene Aircraft: Combustion → E-kerosene Production

Legend:
- Useful Energy
- Lost Energy (Use)
- Lost Energy (Production)
The crunch: Producing Synthetic E-fuel is one of the least efficient methods for using renewable energy to decarbonise our economies.
Carbon Offsetting
CARBON OFFSETTING IS FUNDAMENTALLY FLAWED

CEO of United Airlines:

“Covering entire planet in trees = 5 months of global emissions”

Source: https://www.youtube.com/watch?v=b9x67JN-9hQ (45-46 mins in)
End of Pack – Thanks

#ShowYourStripes
Military Emissions Gap Conference 2023

MILITARY AND CONFLICT GHG EMISSIONS: FROM UNDERSTANDING TO MITIGATION

Tuesday 26 September, University of Oxford, and online
Military Emissions Gap Conference 2023

MILITARY AND CONFLICT GHG EMISSIONS: FROM UNDERSTANDING TO MITIGATION

Tuesday 26 September, University of Oxford, and online

Panel 4: Military carbon footprints: how do we decarbonise?
Dr Karen Bell
University of Glasgow
Decarbonising and diversifying defence in the US & UK

Highlights the views of a cross-section of current and former defence workers on transitioning the defence sector to environmental sustainability in the United States (US) and the United Kingdom (UK).

Fifty-eight interviews were carried out with current and former defence sector workers in the US and the UK between October 2021 and March 2022.

Two trans-national focus groups were also conducted: (1) An ‘International Expert Dialogue’ and (2) an ‘International Trade Union Dialogue’.

The project was supported by an advisory committee with representatives from defence companies, government, NGOs, academia and trade unions in the US and the UK.

Funded by British Academy
Terms and scope of presentation

Decarbonisation: ‘The process of reducing the carbon emissions which contribute to climate change’

Diversification: ‘The broadening of defence sector business to non-military business fields’

Presentation focuses on the latter – multiple environmental crises
Diversification

Some opposed to all forms of diversification

Some want diversification to broaden defence company business to encompass civil operations

Some want a general scaling back of operations and production
Defence sector is essential for responding to threats

- I think it’s [diversification is] irrelevant to the defence sector and counterproductive to the entire reason of defence. The entire reason of defence is to protect the nation. We can’t do that without the tools necessary to do that job.... if we diversified from defence, ... we would basically have no defence. We would lose our capabilities in order to defend ourselves and our interests both at home and abroad. That would, basically, not only render the nation mute but it would make them vulnerable to attacks that go on on a day-to-day basis, both in the cyber infrastructure and on the ground when we’re trying to protect our interests (UK002: male, white, current government defence service).

- ...a strong defence is what you have to have in order to show the world that you can take them on, and the United States ... some people would like to call it ‘the protectors of the world’ ... (US007: female, white, current defence manufacturing).
Defence has high standards that would make transitioning to civil uneconomic

...we are inclined in our industry to understand that we’re not making cars, we’re not making toasters, we’re not making washing machines. The products we make, people's lives depend on, they have to work every time they're used, every time they’re used, no exceptions... So the quality of what we produce is very, very good, but it comes at a very high cost ... (US014: male, white, current defence manufacturing union leader).

The defence and commercial are not the same. One is basically, you’re working at ... speed and, when you’re working in defence, it’s more you’re pushing quality a lot harder. Making sure that you’re not putting soldiers’ lives in danger. With commercial, I would say that management’s focus is on “We have planes on the ground, there’s customers waiting for them, and we need to get this out right now” (US023: male, Latin American, current defence manufacturing).
Broaden defence company business to encompass civil

I think it probably goes back to that ‘spreading the risk’ so, if we take an organisation in the supply chain, is it sensible for them to invest in other, or try and bid for, other work that isn’t defence related? I think that’s probably a good decision. You don’t want to put your eggs in one basket (UK018: male, white, current defence manufacturing).

...there’s the benefit that, if they diversify, they’re not going to be dependent only on government funding. With different administrations funding gets either cut or they get increased so they’re not going to be totally dependent on that (US023: male, Latin American, current defence manufacturing).
Impose limits on arms production and sales

Do we really need any more weapons? I don’t think I can answer that...I think we do need, given the current state of play with the world, I think we do need some kind of defence but, in the same token, are we producing too much? (UK005).

...do we really need to update all our ICBMs [Inter-Continental Ballistic Missiles]? Don’t we have enough to blow up the world three times over, or five times over? (US008: male, white, ex-military).
Money currently spent on defence could be repurposed to meet social needs

• So, if we weren’t spending as much [on defence] or if we were taking that money and putting it towards social needs, those could have a great impact on the quality of life for most Americans in terms of stuff like national healthcare and a lot of the safety net things that, say, most countries in Europe take for granted because they don’t spend as much money on weaponry as we do US011: male, white, current defence manufacturing).

• ... the biggest one is the amount of resources that are taken up, like 40% of the discretionary budget of the US is military... taking up enormous amounts of resources that could be transferred to mitigating the causes of war (UK019: male, white, ex-military, current defence manufacturing).
Some felt uncomfortable about their work

- I am uncomfortable working in the defence industry at large so I am looking to make that move already because I’d rather be working for a business that’s good for the planet (UK022: male, white, current defence manufacturing).

- I guess, it’s funny because one of the reasons that I didn’t wanna come to work at [ANONYMISED defence company] was because of the defence industry. I didn’t wanna work in a factory and I didn’t wanna work in something that supported making machines of war. Obviously, over time that’s worn away but I’ve always said to people here that if something happened and we didn’t have to have war anymore and we didn’t have to make, you know, military engines and, you know, that kind of thing, I would be happy to lose this job and find another. And, if it was in a renewable resource, research or job, that would be fantastic. ...I would feel better about my life if I did that. ... I feel that it’s important that I do my job properly in order to keep people safe.... Would I prefer to do something that was more relevant for the world? Absolutely! (US013: female, white, current defence manufacturing union leader).
BARRIER: Other jobs appear less attractive

• *I think that’s part of the hesitation in transitioning, because these jobs are so good and secure and they pay well and especially the ones that are protected through collective bargaining. I mean, this is a job for life and, in the civilian sector ... it’s impossible to find anything like that. So I think that’s the major stumbling block towards a transition, in my experience. *...Even if I would rather be doing something that there is more of a public good involved, people aren’t as selfless as they would need to be to just walk away from this (US015: male, white, current defence manufacturing).

• *...defence workers get paid high wages, we get paid high wages because the work is very sophisticated and difficult to do, so if everybody goes from making an engine for the Joint Strike Fighter to making toasters, well toasters just don’t bring the same price, so what’s the impact on wages of that? There has to be some kind of figuring out of that part of it* US011: male, white, current defence manufacturing).
BARRIER: Worker identity

• people there are extremely proud of that product which they fully know is the most technically complicated and advanced manufacturing product ever made, even more than a rocket. So, they had that pride and by telling them that they’re making weapons of war really, you know, insulting them, isn’t really the way to go at this. But, beyond the pride, they have pride in their skill and they all want to make good things. It becomes more complicated when you go to defence workers and you say, “well we’re going to cut out these weapons because we need more nurses and teachers and we need more highways” or something, because we’re not nurses and teachers or construction workers US011: male, white, current defence manufacturing).
BARRIER: Vested interests

- ... defence is easy money for companies and doing anything else is risk ... it comes down to the money thing and the incentives. So if the country and the government wants the defence industry to diversify, there needs to be incentives that minimise the risk for them to do that so, whether that’s funding support, whatever, that needs to be there ... the defence industry, from my point of view, is essentially a magic money tree. There is always money available no matter what ... they almost need to be made less dependent on that to make them do other things... I don’t think it’s a priority for the defence sector because I think it is more lucrative to be in the defence sector and be paid public money to develop defence products than it is to be in private sector and take the risk with no guaranteed return (UK022: male, white, current defence manufacturing).

- ... defence work is essentially state run. It’s a state-run industry and the majority of the funding is through the taxpayer. So, for the defence industry to branch out, you’d probably have to have an equal amount of investment from state governments to justify it. ... the private sector is so focused on short term reward that they’re not really going to be interested in putting in the type of investment it would take to transition entire sectors into something out of the defence industry. ... they don’t care where their money comes from as long as they make their money. So, if they can see the same type of profit margin through renewable energy then maybe they will invest as much in that as they have in aviation in the past, but the problem is with defence work it’s kind of like a blank cheque (US015: male, white, current defence manufacturing).
BARRIER: Profit motive

...it’s a very lucrative business for a start. I mean, I think when you have a permanent arms industry that has to make lots of money and sell arms then you’re going to have a dynamic to fight wars (UK019: male, white, ex-military, current defence manufacturing).

...there’s people who live off war and war based industries and you would have to overcome that barrier ...If you can convince them, I think, that they could make as much money in another field, that would be the barrier that would have to be broken (US013: female, white, current defence manufacturing union leader).
BARRIER: The power of the defence sector

• Well, the major barrier is this, for Trident, the only reason they have got it - ...- the only reason they have got it is to keep a seat at the top table of the Security Council at the UN and it's a political thing. It's no’ really a defence weapon, it's a macho thing. Britain is still the imperial power or it thinks it is ... (UK020: male, white, ex-military).

• I always revert back to lobbyists because they’re the ones controlling our politicians. If we can somehow take the money out of the voting system in the States, then we’ll take the power away from lobbyists. ...We’re under the guise of a lot of propaganda, unfortunately. ...if the lobbyists are still there to control the policy, they [the government] realistically won’t do it (US019: male, black, ex-military).

• They donate to the parties, and also to the congressmen and senators themselves, and a lot of times they don’t have to reveal those sources of where that money comes from, so there’s a lot of dark money involved. There’s so many ways of covering up what the sources are, or just hiding it, and they do their bidding (US006: male, white, ex-military).
SOLUTION: government incentives

I guess if defence companies are finding that they're earning sufficient profit from just focusing on defence sales and defence technology then they're not, sort of, forced to change and look at other opportunities. Again, I suppose it's about incentivising companies to do that. I think there are probably lots of opportunities but they're not being pursued at the moment (UK007: female, white, current defence civil service).

We just need to reallocate our budget. Instead of investing in the same technology from [ANONYMISED] – or whoever you want to name in terms of the equipment we’re using – we need to allocate it towards renewable resources, possibly even turning down our engagements in conflicts around the world (US019: male, black, ex-military).
SOLUTION : Government controls

• I think what would make a difference is if Congress, or different countries around the world... the ones that control the purse strings, made it a requirement that a certain percentage of the money that’s spent [on defence] has some [requirement to develop] some of these greener technologies to move away from fossil fuels. ... if they put a priority and said, “In order to get this amount of money to build these (US022: male, white, current defence manufacturing).
SOLUTION: Collective organising

I just really want to stress that organised labour, I think, is the most powerful tool when it comes to shifting economies and industries and even politics. And so, in some ways, it’s easy to be very pessimistic about the last several years but one thing that I am really optimistic about is just how angry workers are right now and how much more power they seem to have than they ever had before (US015: male, white, current defence manufacturing).

...this [defence products] is, basically, the last stuff that we’re making around here. ...because of free trade and because of the lack of US industrial policy, we’re lucky to have anything left. So the idea that we can go ahead and transition and be making something else when everything is going out the door for the past 30 years does not sit well with manufacturing workers. I mean, we know it’s a lie. So, I think that trade agreements have to be addressed (Union Leader, Focus Group Participant).
SOLUTION: New approach to foreign policy

There are drawbacks in wars. Let’s end wars. Let’s stop selling weapons, especially machinery that requires fossil fuels. … I’m a very young person. I’m only 28. … Coming to terms of the reality that I’m born into and now having a son – and you’re aware of where we could have been and that we had the technology to live in a different existence – it’s kind of depressing. It’s hard to swallow. We could do better (US019: male, black, ex-military).

... if we consider the investments that are going into the defence sector side, broadly into nuclear weapons and Trident renewal, for example, and what is the basis for real human security, which is dealing with the climate challenge, which we’ve got such a short time frame now to really make progress ... if you look at the Integrated Strategic Review and how Boris Johnson has positioned global Britain in the world and it’s very much an imperialist and colonialist position that it’s going to be back with greater investments in the defence sector and in arms and militarisation. The biggest increase in the defence budget for 70 years. Increase in nuclear warheads. I think that’s a threat for all of us, and that’s a threat for global security as well (Focus Group participant).
Recommendations

• FOR COMPANIES:
Set up structures and programmes to include workers at all levels to discuss the possibilities and issues in relation to diversification planning and implementation

• FOR UNIONS:
Create more opportunities for education and dialogue around diversification with rank-and-file defence workers

• FOR GOVERNMENTS:
Create a public dialogue on security policies and budgets. Is ‘peace through strength’ what is really wanted or does the public support a ‘human security’ approach, addressing the global and national poverty, inequality, health and environmental crises and investing in the jobs that would accompany this

• FOR WORKERS:
Propose diversification education and dialogue in your company and union
• For more information and to read the project reports, see [Decarbonising Defence (decarbonising-defence.co.uk)](decarbonising-defence.co.uk)
• Email: [Karen.Bell.2@glasgow.ac.uk](mailto:Karen.Bell.2@glasgow.ac.uk)
• Thanks!
Military Emissions Gap Conference 2023

MILITARY AND CONFLICT GHG EMISSIONS: FROM UNDERSTANDING TO MITIGATION

Tuesday 26 September, University of Oxford, and online
Decarbonising the military: a structural approach

Ben Bekkering
IMCCS
climate change – RBIO – security

water as critical resource: freshwater – delta’s and islands – rivers – oceans

- crisis response
- disaster relief
- regional conflict
- strategic competition
- constabulary tasks

inform the debate (and data)
  - INTEL-products
  - need to share

ensure license to operate
  - relevant (first, last)
  - responsible

increase freedom to manoeuvre
  - ready (P, M, training)
  - reduced logistic tail

stimulate green investment
  - launching customer / test bed
  - reduced footprint
freedom to manoeuvre

mission ready (first – last)
interoperability
rules & regulations
launching customer

license to operate
(responsible, accountable, nett-zero)

need to understand
(causes, character, region)

reduced demand

energy requirement

green energy

fossil energy

surplus to compensate

green energy solutions

no green solutions (yet)

rules monitoring reporting

solar
wind
go-thermal
tidal
nuclear

alternative supply

Air bio-fuels unmanned
Maritime hull vane aux. vessels
Land electric vehicles
Base camps nett-positive private-public
organisation new infra etc.

2020
2030
2040
2050

rules monitoring reporting

license to operate
(responsible, accountable, nett-zero)

need to understand
(causes, character, region)

freedom to manoeuvre
(generate, train, operate with reach, autonomy, effect)

mission ready (first – last)
interoperability
rules & regulations
launching customer

reduced demand

energy requirement

green energy

fossil energy

surplus to compensate

green energy solutions

no green solutions (yet)

rules monitoring reporting

solar
wind
go-thermal
tidal
nuclear

alternative supply
Military Emissions Gap Conference 2023

MILITARY AND CONFLICT GHG EMISSIONS: FROM UNDERSTANDING TO MITIGATION

Tuesday 26 September, University of Oxford, and online