CAMPAIGN AGAINST ARMS TRADE

dED demilitarise education

Sheffield University:

Breaching The Moral No-Fly Zone in Military-Industrial Research & Development

A follow-on case study to *Weaponising Universities: Research collaborations between UK universities and the Military Industrial Complex.*

Published by CAAT and Demilitarise Education October 2024

Okopi Ajonye

Overview

This report follows on from one published earlier this year by Campaign Against Arms Trade (CAAT) and Demilitarise Education (dED), "**Weaponising Universities: Research Collaborations between UK Universities and the Military-Industrial Complex**", also by Okopi Ajonye. This report discussed the historical roots, background, and context of the growth of the "Military Industrial-Academic-Complex" (MIAC) in the UK, the key technologies for which the military and arms industry are seeking academic partnerships, along with three case studies of universities with a high involvement in the MIAC: Imperial College London, Southampton University, and Lancaster University. This was followed by a discussion of the ways in which the growth of the MIAC is being resisted by staff and students at various universities, and of how universities might seek to move away from reliance on arms industry and military funding.

The current report provides a case study of Sheffield University (following a similar additional case study of **Strathclyde University**). It is intended as a stand-alone report, but readers seeking more background on some of the concepts discussed in this report, such as the MIAC, Commercialisation, Militarisation, Emerging & Disruptive Technologies (EDTs), and Policy Entrepreneurship, are encouraged to read *Weaponising Universities.*

The University of Sheffield (UoS), which received its royal charter in 1905 and is included among the prestigious Russell Group in the UK,[1] has attracted considerable controversy and protest for its heavy involvement in the military-industrial-academic complex (MIAC). A study by Action on Armed Violence (AOAV) revealing extensive arms company research funding of UK universities since 2013, including UoS as shown below, also found that UoS received the most funding.[2] Another report titled "Study War No More" revealed that, following Cranfield University, UoS was "involved in the second and third most valuable military projects" of the universities investigated.[3]

Table: Sheffield University research funding from arms companies 2013-2020

Arms Company	Value
Rolls Royce	£33,815,057.82
BAE Systems	£6,734,342.47
Airbus	£4,827,839.07
QinetiQ	£1,364,544.80
Leonardo	£226,604.86
Serco	£23,158.80

Source: *Action on Armed Violence*

One of these projects, which is a center that has been a focal point of much of this protest and commentary, valued at £18 million, is the Advanced Manufacturing Research Centre (AMRC), which was formed in 2001.[4] The AMRC has different membership tiers, and Tier-1 consists of several prominent arms companies including Airbus, BAE Systems, Boeing, and GKN Aerospace.[5] The AMRC emerged from a foundation of academic-

1 Russell Group (undated) University of Sheffield https://tinyurl.com/52vur829
2 Creffield, M. Jones, M. Tacchi, J. 2021. UK universities funded £190 million from major arms manufacturers since 2013. Action on Armed Violence. https://tinyurl.com/4c7z456x
3 Beale, M. Street, T. 2007. Study War No More: Military Involvement in UK Universities. Campaign Against the Arms Trade, Fellowship for Reconciliation. p.19
4 ibid 2007, p.19
5 University of Sheffield. AMRC (undated) Tier 1 Members. https://tinyurl.com/hnz22yxs

industrial collaboration, and was envisioned as a research center that could bridge the gap between university research and manufacturing challenges.[6] However, given the extensive membership of arms companies, the AMRC's focus is heavily tilted towards addressing the specific manufacturing challenges of the arms industry. Additional information of UoS's involvement with the military and arms companies was also provided by a report released by the Student Campus Coalition for Palestine (SCCP) in 2024, which also revealed ties between UoS and various companies and entities complicit in genocide and apartheid committed by Israel.[7]

As the following will show, UoS is not only complicit in upholding Israeli apartheid as detailed in the SCCP report, but is also in collaboration with a company complicit in upholding what US abolitionist scholar Catherine Besteman describes as "militarised global apartheid", defined as "a loosely integrated effort by countries in the global north to protect themselves against the mobility of people from the global south" and which "takes the form of militarized border technologies and personnel".[8] Additionally, UoS's research & development (R&D) has been linked to military technologies implicated in some of the worst humanitarian crises in recent history. Before investigating these collaborations, the next section will provide a brief outline of UoS's involvement in a cluster that can accelerate the commercialisation and militarisation of academic institutions.

Given the extensive membership of arms companies, the AMRC's focus is heavily tilted towards addressing the specific manufacturing challenges of the arms industry

The High Value Manufacturing Catapult

Catapults, launched in 2011, are Research Technology Organisations working to streamline the transition of research to commercial adoption. There are nine Catapults spread across the UK, one of which is the High Value Manufacturing Catapult (HVMC), which collaborates with arms companies and includes academic-linked institutions such as the AMRC and National Manufacturing Institute Scotland (NMIS) in its membership.[9] The latter is led by the University of Strathclyde and is involved in military projects such as applying advanced manufacturing to warships for BAE Systems.[10] Much of the research undertaken by academic institutions such as the AMRC and NMIS, including those with military purposes, is performed in association with the HVMC and broader Catapult framework. By "helping to move cutting-edge manufacturing research from the UK's world leading universities into the commercial market", as described on its website,[11] the HVMC and Catapults more broadly intensify the commercialization of academia by expediting the process through which academic research is brought to market.

Yet, the need for such commercialisation, particularly in relation to military projects, should be interrogated. When research is perceived as too closely tied to industrial interests, it can ferment suspicion and distrust among the public.[12] Public legitimacy of universities rests on the belief that academic institutions serve the public good,[13] not the particularistic interests of industry, especially those of the arms sector, whose

6 University of Sheffield. AMRC (undated) Our story. https://tinyurl.com/2brnu2x8
7 Sheffield Campus Coalition for Palestine 2024. Sheffield University Genocide and Apartheid Complicity Report.
8 Besteman, C. 2019. Militarized Global Apartheid. Current Anthropology. Volume 6, Supplement 19. p.26
9 Department for Science, Innovation, and Technology 2023. 2023 Update to the "Catapult Network Review". OGL. p.15
10 For more information on such shipbuilding collaborations between BAE Systems and Strathclyde University, see Ajonye, O. 2024. "Strathclyde University: Navigating the Murky Waters of the Military-Industrial Academic Complex". CAAT, Demilitarise Education
11 High Value Manufacturing Catapult. Our history: Accelerating manufacturing innovation. https://tinyurl.com/e9x7vhfs
12 Caulfield, T. Ogbogu, U. 2015. The commercialization of university-based research: Balancing risks and benefits. BMC Medical Ethics. 16 (70) pp. 1-7, p.4
13 Ivancheva, M. Lynch, K. 2015. Academic freedom and the commercialisation of universities: a critical ethical analysis. Ethics in Science and Environmental Politics. 15. pp.71-85. p.75

interests are often misaligned with the public interest. This public service mandate has historically laid the basis of public funding of universities.[14] However, government funding of universities has instead been increasingly justified on the basis of economic and industrial contributions that universities can provide to various sectors,[15] which is a rationale that departs from this public service mandate. This case study will provide examples of how academic contributions from UoS are specifically driving the economic competitiveness of the arms industry.

The HMVC can also propel the militarisation of academia. According to the Technology Programme Manager at the National Composites Centre, the HVMC is exploring how to streamline work with the Ministry of Defence (MOD) to more effectively support military purposes laid out in official documents such as the Defence Technology Framework (DTF),[16] which outlines seven "technology families" or "emerging and disruptive technologies" (EDTs) believed to be essential to expedite a revolutionary transformation of the military. Insofar as the militarisation of academia can be understood as the allocation of academic labor and resources to military purposes, then the HVMC, and its associated academic institutions such as the AMRC, are working to better anticipate and more rapidly respond to military interests in technologies such as EDTs.

The next section explores key research undertaken and currently in progress by the MIAC in UoS. Some projects are related to the development of highly problematic aerospace technologies for arms companies. UoS's research contributions in these areas largely consist of providing R&D to one category of conventional weapons systems – combat aircraft. Another project involves an EDT included in the MOD's DTF, with potentially ominous military applications. The subsequent section discusses resistance to the militarisation of academia at UoS by staff and students, and suggests ways forward for UoS and other universities to disentangle themselves from the MIAC, and instead promote a more peaceful world. Conclusions and recommendations follow.

14 ibid 2015, p.75
15 Geuna, A. 2001. The Changing Rationale for European University Research Funding. Are There Unintended Negative Consequences? Journal of Economic Issues 35 (3) pp.607-632. p.617
16 Croft, H. 2020. Bridging the Valley of Death: High Value Manufacturing & UK Defence Innovation. Defence IQ. https://tinyurl.com/yp3p5hyv

Key Research Partnerships

Table: Key partnerships with the military and arms industry at UoS

Areas of Expertise Under Investigation	Key Military/Industrial Partnerships	Value of Partnership
Apprenticeships	Boeing	Unknown
Industry 4.0	United States Air Force (USAF), BAE Systems, Boeing	USAF – Unknown BAE Systems – Unknown Boeing – £850,000
Advanced Materials	Defence Science and Technology Laboratory (Dstl),EPSRC, MBDA	Dstl – £42.5 million EPSRC and SFI Centre for Doctoral Training (CDT) in Advanced Metallic Systems – £5,716,547 Affordable Titanium to Useable Defence Equipment programme (ATiTUDE) – £3.5 million

Boeing & The P-8 Poseidon

Boeing is an aerospace company with economic activities in the commercial and military sectors. According to the Stockholm International Peace Research Institute (SIPRI), Boeing ranked 4th in the 2022 rankings of the top 100 arms-producing and military-services companies. While arms revenue accounted for less than half (44%) of its total revenue,[17] it nonetheless plays a central role in the US arms industry, and its weapons have caused considerable harm to civilians. For example, there have been numerous instances in which Boeing-manufactured "GBU-39" munitions, which are designed to be smaller and intended to be "more discriminate and precise" bombs,[18] have been used against civilians in the war in Gaza, beginning late 2023. For example, one occurred in a camp, killing 45 and injuring 200,[19] and another in a school, killing 93, including many civilians, elderly, women, and children.[20] Additionally, an analysis of SIPRI's arms transfer data, U.S. Air Force (USAF) and Boeing fact sheets identified Boeing as the leading arms manufacturer of missiles and munitions delivered to Israel from 2021-2023, surpassing even Lockheed Martin,[21] the largest arms company globally; whose military business, in contrast to Boeing, comprises the vast majority of its total revenue.[22] Boeing also produces other critical conventional weapons systems for Israel and other countries, such as F-15 fighter aircraft and Chinook helicopters.[23]

Boeing and the AMRC have developed a strong and long-term relationship. Indeed, Boeing co-founded the AMRC,[24] and Sheffield is the site of the first European Boeing

17 Béraud-Sudreau, L. Choi, Y. Liang, X. Scarazzato, L. Tian, N. Da Silva, D.L. Sild, E.K. 2023. The SIPRI Top 100 Arms-Producing and Military Services Companies, 2022. Stockholm International Peace Research Institute. Fact Sheet. p.9

18 Jakes, L. 2024. A Small American Bomb Killing Palestinians by the Dozen in Gaza. The New York Times. https://tinyurl.com/4hyrr8vv

19 Goodwin, A. 2024. U.S.-made munitions used in deadly strike on Rafah tent camp, CNN analysis shows. CNN. https://tinyurl.com/2p8efmap

20 Dahman, I. Goodwin A. Harvey, L. Nasser, I. Salman, A. Tawfeeq, M. 2024. Israeli strike on mosque and school kills scores, sparking international outrage. CNN. https://tinyurl.com/56z5jdu5

21 Popescu, T. 2024. Off the Charts: Boeing was top U.S. manufacturer of missiles and munitions delivered to Israel from 2021-2023. KUOW. NPR Network. https://tinyurl.com/4bv678nx

22 Béraud-Sudreau, L. Choi, Y. Liang, X. Scarazzato, L. Tian, N. Da Silva, D.L. Sild, E.K. 2023. The SIPRI Top 100 Arms-Producing and Military Services Companies, 2022. Stockholm International Peace Research Institute. Fact Sheet. p.9

23 AFSC Investigate (undated) Boeing Co. https://tinyurl.com/mv4kf45z

24 Boeing (undated). Boeing Sheffield. https://tinyurl.com/bdr4kuts

manufacturing facility, located in South Yorkshire.[25] Consistent with the pattern of local companies collaborating with universities for apprenticeship provision,[26] the AMRC Training Centre, which provides apprenticeship programmes,[27] collaborates with the Boeing Sheffield Factory to train industry-sponsored apprentices; many of whom eventually secure employment in the Boeing Sheffield factory.[28] Demilitarise Education (dED)'s research shows that Boeing has significantly leveraged these apprenticeship opportunities from UoS, having been involved in these programmes for five years, unlike other major arms companies, such as Airbus, Babcock International, and BAE Systems, which have shown no involvement in the same time period. The highly active role of UoS in training apprentices for Boeing's Sheffield factory ought to invite close inspection of the specific technologies being manufactured in this facility, particularly regarding their potential ethical implications.

Boeing's Sheffield factory produces components for Boeing military products, such as the P-8 Poseidon aircraft.[29] In 2019, the UK Royal Air Force (RAF) published a press release revealing that apprentices working in association with the AMRC were involved in the P8 Poseidon Programme.[30] The P-8 Poseidon, described as a "militarised version of the Boeing 737 commercial aircraft", carries out maritime patrol and is capable of performing military functions such as intelligence, surveillance, reconnaissance, search and rescue operations, as well as anti-submarine warfare and anti-surface warfare.[31] Amid rising tensions with Russia, P-8 aircraft have been deployed by the RAF for maritime surveillance of Russian vessels close to British waters.[32] However, this aircraft has also been deployed for maritime surveillance of migrants' boats in the English channel, as part of an initiative by the MOD to support Border Force operations.[33] The P-8 hence illustrates how technology deployed for military purposes such as monitoring Russian vessels can be repurposed to surveil vulnerable civilian populations. The advanced surveillance capabilities installed on the P-8 make it highly effective for finding and tracking submarines as well as border surveillance. Boeing in particular plays a leading role in border operations as Immigration and Customs Enforcement in the U.S. have predominantly relied on Boeing aircraft to conduct aerial deportations.[34]

The deployment of military technology such as the P-8 to surveil borders reflects a "securitised" perspective on migration, in which migration is framed as a threat to national security and the cultural and social fabric of destination countries.[35] Such "securitisation" is used to seemingly justify the use of extraordinary and militarized responses to migration, like deploying surveillance aircraft such as the P-8, ships, and drones.[36] This framing of migration as a matter of security is not a novel development, but certain contemporary circumstances are intensifying this trend both globally and nationally. At the international level, heightened geopolitical tensions between NATO states, Russia, and China has amplified the securitisation of migration as some

25 Shroot, H. (undated) Boeing Sheffield Factory celebrates 5th anniversary. Boeing https://tinyurl.com/bddwd8kp
26 Hyslop, G. 2017. Innovation Quarterly. Volume 1. Issue 6. p.29
27 University of Sheffield. AMRC Training Centre. About us. https://tinyurl.com/26vfcdr2
28 Shroot, H. (undated) Boeing Sheffield Factory celebrates 5th anniversary. Boeing https://tinyurl.com/bddwd8kp
29 ibid (undated)
30 Royal Air Force 2019. Team Responsible for P-8 Poseidon visit Factory in Sheffield https://tinyurl.com/3dn6mzsm
31 Military.com (undated) P-8A Poseidon. https://tinyurl.com/ytvdj4ez
32 Hill, J. 2023. UK Armed Forces conduct maritime surveillance of Russian Vessels. Airforce Technology https://tinyurl.com/2uhzky6c
33 BBC News. Kinloss-based RAF plane sent to monitor English Channel https://tinyurl.com/2zfn45c8
34 AFSC Investigate (undated) Boeing Co. https://tinyurl.com/mv4kf45z
35 Castles, S. Hass, H. Miller, M.J. 2020. The Age of Migration: International Population Movements in the Modern World. (Red Globe Press, United Kingdom) p.232
36 Benedicto, A.R., Brunet, P. Akkerman, M. 2020. A Walled World: Towards a Global Apartheid. Stop Wapenhandel. Transnational Institute. Centre Delás D'estudio Per La Pau. Palestinian Grassroots Anti-Apartheid Wall Campaign. p.5

NATO state officials have framed migration as an instrument of "hybrid war" i.e. when adversarial states deploy nonmilitary tools, such as irregular migrant flows, alongside military instruments as part of an overarching plan to destabilize target societies.[37] On the national level, the UK government has increasingly equated national security with border security, which has resulted in policies that treat migrants as national security risks, such as the "stop the boats" campaign.[38]

Militarised responses result in a range of negative consequences for migrants. These actions often compel migrants to take more perilous routes across borders, leading to a growing number of migrant deaths at sea.[39] Furthermore, as safe and legal passage becomes increasingly restricted, migrants rely even more on smugglers to facilitate border crossings, which expands parallel markets where smugglers exploit and profit from the desperation of migrants.[40] Additionally, these smugglers often collaborate with authorities to also profit from intercepting migrant flows,[41] which further deepens their exploitation of refugees. Meanwhile, the militarisation of borders has become a lucrative business for the arms industry. Arms companies such as Boeing have amassed considerable profits from providing border security technologies.[42] Additionally, the homeland security market, which thrives on the demand of these technologies, is anticipated to reach a staggering value exceeding 900 billion USD by 2032,[43] so arms companies stand to significantly profit from the securitisation and ensuing militarisation of borders, which simultaneously worsens conditions for migrants. Militarising borders is also a manifestation of the broader militarisation of society, which extends beyond universities to other examples such as policing.

Therefore, by providing training to apprentices who went on to be employed in the Boeing Sheffield Factory, UoS developed a workforce that partook in the manufacture of technology that militarizes borders and contributes to considerable suffering and death to vulnerable migrants. These academic partnerships reveal the need for universities such as UoS to cultivate a workforce that is sensitive to the broader ethical and social impact of their work; rather than one that simply fulfills the skills requirements of their industrial partners. The following section will demonstrate how the AMRC's involvement in research for the arms trade has contributed to significant negative impacts on other civilian populations, thus highlighting the need for the social responsibility of university researchers as well as the future workforce.

These academic partnerships reveal the need for universities such as UoS to cultivate a workforce that is sensitive to the broader ethical and social impact of their work; rather than one that simply fulfills the skills requirements of their industrial partners

37 Overhaus, M. 2021. War everywhere? Why the crisis on the Polish-Belarusian border is not a hybrid attack. Stiftung Wissenschaft und Politik. https://tinyurl.com/yyu54m8s

38 UK Parliament 2023. Hasard. Illegal Migration Bill. Volume 729. https://tinyurl.com/mt9btbd5

39 Doherty, L. Mankarious, S.G. Manley, B. Polglase, P. 2023. Britain's Shadowy Border. CNN. Special Report. https://tinyurl.com/dmj25mh2

40 Castles, S. Hass, H. Miller, M.J. 2020. The Age of Migration: International Population Movements in the Modern World. (Red Globe Press, United Kingdom) p.232, p.66

41 Arar, R. Scott FitzGerald, D. 2018. The Sociology of Refugee Migration. Annual Review of Sociology 44 (8). pp. 8.1-20, p.8.11

42 Shalal-Esa, A. 2007. Boeing sees growth, risk in U.S. homeland defense. Reuters. https://tinyurl.com/853dpxz6. Similarly Airbus, Leonardo, and Thales, see e.g. Mark Akkerman, "The business of building walls"; Transnational Institute, 5 November 2019, https://tinyurl.com/mr3d4z5h

43 Global Market Insights 2024. Homeland Security Market to Surpass $900 Bn by 2032. https://tinyurl.com/3xt2c39a

Industry 4.0 & Aerospace

The MIAC is accelerating the industrial adoption of "Industry 4.0", which consists of integrating "digital technologies", such as automation and robotics, into manufacturing operations to lower production costs and increase efficiency to boost value for companies,[44] although there is also growing military interest in these technologies.[45] In 2022, a delegation from the RAF Lakenheath, an airbase linked to USAF, visited the AMRC to explore potential cooperation in incorporating advanced manufacturing and digital technologies into maintenance, repair, and overhaul processes.[46] RAF Lakenheath serves as the base for the 48th Fighter Wing, which is featured on its official webpage for its participation in combat missions and support during the wars in Afghanistan and Iraq,[47] which both led to thousands of civilians killed and millions displaced.[48] As the following examples illustrate, the AMRC has collaborated with industrial partners for Industry 4.0 with a similarly sordid past and present.

The AMRC has collaborated with BAE Systems to introduce Industry 4.0 technologies to the support and development of three aircraft central to the UK's Sovereign Combat Air Capability: the Eurofighter Typhoon, which is finally assembled and delivered from the UK, the F-35 II Lightning, Joint Strike Fighter, developed in partnership with Lockheed Martin, and the future Tempest, the planned successor to the Typhoon, which is developed as part of a joint enterprise with Italy and Japan titled the Global Combat Air Programme (GCAP).[49] In 2019, a production-ready version of an intelligent workstation, equipped with digital technologies and developed by the AMRC, was implemented into the assembly operations of Typhoon Aircraft at a BAE Systems facility in Lancashire.[50] In 2023, the AMRC joined Future Air Support with BAE Systems for further collaboration into integrating digital technologies and green solutions into aircraft for the RAF, including Typhoon and Tempest, to lower costs and greenhouse gas (GHG) emissions.[51] The latter objective reflects the military's interest in adapting its infrastructure and systems to climate change. The military-industrial complex is seeking to lower GHG emissions through several means including the integration of digital technologies. In the case of Tempest, such climate objectives may be achieved via the aircraft's anticipated unmanned capabilities, as unmanned systems have been promoted by the military as a mechanism for lowering GHG emissions.[52]

These "green" solutions may also contribute to the RAF's aim to be the world's "first Net Zero air force", through diversifying energy sources through the use of renewables such as hydrogen,[53] which reflects the broader objective of the branches of the UK military to play a leading role in embracing environmental technologies, as also exemplified by the Royal Navy's aim to possess the "world's greenest fleet".[54] However, the military is also exploring how these green solutions can provide significant advantages in warfare. For instance, hydrogen-fueled combat aircraft can boost energy efficiency and not only

44 Bennett, J. 2018. What is Industry 4.0? Blog. BAE Systems. https://tinyurl.com/43vuwh3y
45 For more information on Industry 4.0 and the MIAC's interest in these digital technologies, see Ajonye, O. 2024. "Strathclyde University: Navigating the Murky Waters of the Military-Industrial Academic Complex". CAAT, Demilitarise Education
46 University of Sheffield AMRC 2022. U.S- Air Force fly into the AMRC https://tinyurl.com/zneuwpnw
47 Royal Air Force Lakenheath. About us. 48th Fighter Wing. https://tinyurl.com/26kjv6pt
48 Watson International & Public Affairs (undated). Costs of War. Brown University. https://tinyurl.com/3tuwbbuy
49 BAE Systems 2024. Unleashing the power of Combat Air. p.6-7
50 Kay, A. (undated). The "brain" behind our intelligent workstations. BAE Systems.https://tinyurl.com/4rjyf24e
51 Richardson, M. 2023. AMRC co-pilots Future Air Support with BAE Systems. Aerospace Manufacturing. https://tinyurl.com/2p9scd4k
52 Macfarlane, S. Volcovici, V. 2023. Insight: World's war on greenhouse gas emissions has a military blind spot. Reuters. https://tinyurl.com/2dwcpfdj
53 Ministry of Defence 2024. FCAS Sustainability Strategy. p.19
54 For more information on Navy plans for a green fleet and academia's role in this initiative, see Ajonye, O. 2024. "Strathclyde University: Navigating the Murky Waters of the Military-Industrial Academic Complex". CAAT, Demilitarise Education.

Artists impression of (top to bottom) the F-35 Lightning II, the Eurofighter Typhoon, and the future Tempest aircraft
Source Concept Art from Combat Air Strategy Paper, Crown Copyright

reduce emissions but also infrared exposures,[55] thus potentially making these aircraft less trackable and detectable by infrared missiles.[56] Adapting conventional weapons systems such as combat aircraft to climate change may hence provide a "green" pretext for the higher military objective of enhancing the performance and effectiveness of military assets. Additionally, as has been argued elsewhere, it is highly unlikely that the military can achieve a green transition at the necessary speed and scale, with alternative so-called 'sustainable' aircraft fuels remaining an unproven technology.[57] The exorbitant costs of sustainable aviation fuels are also likely to further dissuade the arms industry from swiftly adopting these green solutions,[58] so declarations to "decarbonise" military systems may merely be a "greenwashing" tactic.

Beyond the Tempest and Typhoon, the AMRC has made substantial contributions to the F-35 Lightning II aircraft, which is one the principal combat aircraft employed by Israel. The AMRC developed an automated process for providing fuselage panels for several hundred F-35 aircraft for BAE Systems, which resulted in significant cost-savings for the company.[59] BAE's motivation to approach AMRC for this research was driven by the inadequacy of robotic applications in the commercial sector, such as in automotive manufacturing, to achieve the high level of precision needed for military stealth aircraft technology such as the F-35 ,[60] which is a strong testament to the AMRC's specialty

55 Blackwell, K.E. 2007. CRS Report for Congress. The Department of Defense: Reducing its Reliance on Fossil Fuel-Based Aviation Fuel – Issues for Congress. Congressional Research Service. p.14 https://tinyurl.com/mfmxhubn
56 Australian Government. Department of Defence (undated) Infrared Signature Management for Aircraft. Defence Science and Technology Group. https://tinyurl.com/rhcpukjk
57 Edwards, N. Rhogaly, K. 2024. Against a Military Transition. The Break Down. https://tinyurl.com/4zmw2ypp
58 Dowling et al 2024. Sustainable aviation fuel technologies, costs, emissions, policies, and markets: A critical review. Journal of Cleaner Production. Volume 449
59 University of Sheffield (undated) Automating BAE Systems defence aircraft manufacture. Impact Case Study. REF 2021.
60 ibid (undated)

in addressing the unique manufacturing challenges faced by the arms industry. The AMRC's proficiency in developing such high-accuracy robotics has also deepened collaboration with Boeing. The AMRC and Boeing launched a Flexible Robotic Machining in High Accuracy Applications project which has the ambitious aim of creating what the head of the AMRC's Integrated Manufacturing Group at Factory 2050 described as "the most accurate large volume machining robot in the world".[61] Research outcomes are expected to benefit various commercial sectors, including commercial aerospace, automotive, and maritime, while also being applicable to the military sector.[62]

By introducing such advanced manufacturing and digital technologies to increase efficiency and lower costs, the AMRC can boost the competitiveness and profitability of their industrial partners. For example, BAE Systems has directly linked its increased profitability to enhancements in efficiency.[63] Additionally, as academics work to increase the economic growth of arms companies, universities that hold investments in these companies can also benefit from such work by potentially achieving higher returns on their investments due to the increased profitability. However, such financial gains come at a significant human cost to the civilian populations that have been victimized by such military technologies.

The UK has exported Typhoon aircraft to authoritarian regimes such as Saudi Arabia, Oman, and Qatar.[64] Beginning in 2015, Saudi Arabia and the equally undemocratic United Arab Emirates (UAE) led a coalition that waged a brutal war in Yemen as Typhoons deployed by Saudi Arabia targeted civilians and civilian objects, killing and injuring thousands of civilians and resulting in a catastrophic humanitarian crisis.[65] In 2019, a UK Court of Appeal ruled that granting arms export licenses to Saudi Arabia during this crisis was unlawful.[66] (Notably, the year of the introduction of the intelligent workstation developed by the AMRC to the assembly of Typhoon aircraft coincided with this ruling and the aircraft's controversial use in Yemen).

These exports powerfully undermine the UK's professed commitment to champion human rights, democracy, and international humanitarian law around the world.[67] This discrepancy reveals how the arms trade in practice tends to subordinate these declared values to economic and strategic priorities, which implies that UoS is contributing to the development of highly dangerous and lethal military technologies that lack proper moral oversight. For example, the UK's revision of its Strategic Export Licensing Criteria in 2021, which permits arms transfers if there is only a "theoretical" risk of misuse, according to one expert, signals the prioritization of strategic considerations at the expense of international humanitarian law in the UK's governance of arms exports.[68]

Just as arms companies profit from border militarisation, so has the arms industry recently drawn record profits from war and destruction.[69] In one case illustrating the dominance of economic concerns over ethics, when Germany blocked a Typhoon sale to Saudi Arabia out of concerns with the situation in Yemen, the UK government, along with partners involved in the manufacture of the Typhoon, exerted diplomatic pressure on Germany to reverse its position to avert job losses that were feared to result from

61 University of Sheffield AMRC 2017. AMRC project targets a step change in the capabilities of robots used in aerospace. https://tinyurl.com/3nsxnd48
62 ibid 2017.
63 BAE Systems plc. (undated) Preliminary Results Announcement 2023. https://tinyurl.com/42nywnu4
64 Lake, J. 2023. UK Typhoons forge stronger links in the Middle East. Times Aerospace. https://tinyurl.com/v4e4cx7p
65 Vredesactie (undated) The Air War. War in Yemen, Made in Europe. https://tinyurl.com/nhbvhkxa
66 Mckernan, B. Sabbagh, D. 2019. UK arms sales to Saudi Arabia unlawful, court of appeal declares. The Guardian. https://tinyurl.com/2t2m5zut
67 HM Government 2021. Global Britain in a competitive age. The Integrated Review of Security, Defence, Development, and Foreign Policy. p.14, 79
68 Graham-Harrison, E. 2021. New rules on UK arms trade make it "easier" to sideline human rights. The Guardian. https://tinyurl.com/38zemr7n
69 Hartung, W. 2024. Weapons stocks blast off as bombs drop, troops invade Lebanon. Quincy Institute for Responsible Statecraft. https://tinyurl.com/2yw4hxj3

the suspension.[70] Since combat aircraft constitute most of the UK's major conventional weapons exports, and the Middle East – a region overwhelmingly ruled by authoritarian regimes such as Saudi Arabia and the UAE – is the largest market for the UK's military exports,[71] such unethical markets are nevertheless essential for sustaining domestic employment in the arms industry, which, as shown in Yemen, downplays official concern with how these weapons are used and against whom they are used. As will be later shown, universities can more effectively contribute to peace, security, and economic and environmental development by helping to reduce such dependency. Additionally, Saudi Arabia has expressed interest in joining the GCAP, and this interest has been reciprocated by the UK,[72] which ought to raise human rights concerns of the program and academic participation in it.

Another state that has deployed combat aircraft to highly deadly effect against civilians is Israel. Similar to Yemen, Israel's military onslaught in Gaza from late 2023, with the use of weapons systems such as the F-35, has resulted in one of the world's worst ongoing humanitarian crises, with over 42,000 Palestinians currently killed in just over a year, with data from the Gaza health ministry showing that women and children account for a majority of the verified casualties.[73] Earlier in 2024, legal advice provided to the UK government by various legal advisers, including from the UK chair of Foreign Affairs Select Committee, concluded that Israel had violated the laws of war, which should entail the immediate halt of arms transfers to Israel.[74] The UK eventually imposed a very limited suspension of arms licenses to Israel, but notably exempted components for the F-35.[75] Yet, a media investigation revealed that F-35 aircraft armed with GBU-31 bombs, which are larger and have more explosive power than the previously described GBU-39,[76] were used to attack a humanitarian zone in Gaza, which resulted in heavy civilian casualties, and which an international law expert deemed as contravening humanitarian law.[77] On the 29th of December 2023, South Africa instituted legal proceedings against Israel before the International Court of Justice (ICJ), accusing Israel of violating its obligations under the Genocide Convention, and several countries have joined South Africa's case.[78] On January 2024, the ICJ delivered an interim judgement declaring that Palestinians hold plausible rights under the Genocide Convention that were at risk of being irreparably damaged by Israel's military conduct,[79] which, on closer examination, suggests that it is plausible that Israel's actions constitutes genocide in Gaza.

On a separate note, the environmental benefits from reducing emissions from combat aircraft appear hollow and superficial in light of the widespread infrastructural destruction caused by weapons systems in Gaza and warfare in general. Postwar removal of debris imposes a heavy carbon burden on the environment due to the frequent vehicle journeys required to clean the wreckage.[80] Furthermore, according to

70 Bambridge, J. Burchard, H.V.D. Kayali, L. Larson, C. 2024. Germany holds its nose, paving the way for future fighter jets to Saudi Arabia. Politico Europe. https://tinyurl.com/bdf7n776
71 Kirk-Wade, E. 2023. UK arms exports: statistics. House of Commons Library. p.4-5
72 Helou, A. 2024. Saudi Arabia "keen" to join GCAP fighter program, but localization a must: GAMI governor. Breaking Defense. https://tinyurl.com/5n7ran2u
73 Reuters 2024. Gaza's death toll: how many Palestinians has Israel's campaign killed? https://tinyurl.com/2s85r2bn
74 Helm, T. 2024. UK government lawyers says Israel is breaking international law, claims top Tory in leaked recording. The Guardian https://tinyurl.com/4mp22wt4
75 Holden, M. James, W. 2024. UK suspends 30 of its 350 arms export licenses to Israel. Reuters. https://tinyurl.com/mry7uudy
76 Military.com (undated) Joint Direct Action Munition JDAM. https://tinyurl.com/37fu624t
77 Andersen, L.S. Gjerding, S. 2024. Dansk-udstyrede kampfly deltog i angreb i Gaza med store civile tab. Information. https://tinyurl.com/bdzhjcbs
78 International Court of Justice (undated). Latest Developments. Application of the Convention on the Prevention of the Crime of Genocide in the Gaza Strip (South Africa v. Israel). https://tinyurl.com/a5s3vx65
79 Casciani, D. 2024. Israel-Gaza: What did ICJ ruling mean in South Africa's genocide case against Israel? BBC. https://tinyurl.com/ycyhpvp3
80 Darbyshire, E. 2021. How does war contribute to climate change? Conflict and Environment Observatory. https://tinyurl.com/y6w4u98f

an assessment from UN-HABITAT and the United Nations Environmental Programme (UNEP), the amount of debris generated in Gaza in nearly a year since late 2023 is 14 times greater than that accumulated in conflicts over the last 16 years.[81] The United Nations Reliefs and Work Agency (UNRWA) has estimated that it may even take 15 years to fully clear the rubble.[82]

Academics involved in the development of aerospace components – whether on something as seemingly "minor" as fuselage panels – are implicated in the broader consequences of how these aircraft are used, to the extent that such seemingly minor contributions are collectively essential to the functioning of the entire aircraft.[83] Therefore, universities such as Sheffield must assume responsibility for scientifically contributing to an industry that has caused mass civilian death and immiseration, and is also governed by economic and strategic calculations rather than ethical and human rights considerations. Such consequences manifest in civilian victimization and the global perpetuation of abuses to humanitarian law. Furthermore, while the arms trade in practice is marginally affected by human rights concerns, such concerns have been even more more sidelined in favor of strategic interests during geopolitical crises such as the Cold War[84] and the global war on terror.[85] Therefore, the current Cold War conditions re-ignited by the resurgence of great power rivalry has the potential to further lower concern for ethics and human rights in arms trade decisions. In light of these factors, universities should critically reassess their partnerships with arms companies since they not only deprioritize ethics but are likely to give even less weight to ethical considerations in the future. Such partnerships pose a grave threat to UoS's declared priority to achieve positive, lasting impact through their research.[86]

Academics involved in the development of aerospace components – whether on something as seemingly "minor" as fuselage panels – are implicated in the broader consequences of how these aircraft are used

Advanced Materials

Resurgent great power conflict is also intensifying geopolitical competition over Emerging and Disruptive Technologies (EDTs), which the UK and major and emerging powers see as central to their future technological and military power. One of the EDTs in the government's Defence Technology Framework (DTF) is advanced materials, defined in the framework as materials "whose structure and function has been designed to support specific applications", and UoS is developing advanced materials that lead to applications reflecting those outlined in the DTF, such as materials for extreme environments and cost reductions.[87] Materials science has often been the focus of the MIAC in UoS. In early 2024, UoS became a partner in the Defence, Science, and Technology Laboratory's (Dstl) Defence Materials Centre of Excellence, to explore the development of materials for extreme environments.[88] dED's research shows that one of the highest valued military-industrial research partnerships in UoS is the EPSRC and SFI Centre for Doctoral Training (CDT) in Advanced Metallic Systems. Besides the Dstl, the project has Airbus, Rolls Royce, and GKN Aerospace as arms company partners.[89]

Universities such as Sheffield must assume responsibility for scientifically contributing to an industry that has caused mass civilian death and immiseration

81 UNITAR (undated) Gaza: Debris Generated By The Current Conflict is 14 Times More Than The Combined Sum of All Debris Generated By Other Conflicts Since 2008. https://tinyurl.com/2s4kyycc
82 Al Jazeera 2024. Cleaning Gaza rubble could take 15 years, UN agency says. https://tinyurl.com/3kbu5phh
83 Lackey, D.P. 1989. Military Funds, Moral Demands. Personal Responsibilities of the Individual Scientists. Annals of the New York Academy of Sciences. 577 (1) pp. 122-130. p.128
84 Erickson, J.L. 2015. Dangerous Trade: Arms Exports, Human Rights, and International Reputation. (Columbia University Press, New York). p.44
85 Stohl, R. 2008. Questionable Reward: Arms Sales and the War on Terrorism: Arms Control Association. https://tinyurl.com/yemtdtm7
86 University of Sheffield (undated) Priority one: Impact. https://tinyurl.com/3vjhnbpa
87 Ministry of Defence 2019. Defence Technology Framework. Defence Science and Technology.
88 Engineering at Sheffield. 2024. Sheffield to partner in new £42.5m Dstl Materials Centre of Excellence. University of Sheffield. https://tinyurl.com/3mv8dcwu
89 Engineering and Physical Sciences Research Council 2018. EPSRC and SFI Centre for Doctoral Training in Advanced Metallic Systems: Metallurgical Challenges for the Digital Manufacturing Environment. Details of Grant. https://tinyurl.com/2p9zcta4

One of several challenges emphasized by this partnership is developing propulsion systems capable of reaching over Mach 5 for the next generation of hypersonic air and space vehicles,[90] which is a priority EDT for the military that can travel at five times the speed of sound i.e. Mach 5. Meeting such a challenge may be of interest to Rolls Royce, which is a manufacturer of propulsion systems and is collaborating with other military and industry partners in a separate project to enhance hypersonic technologies.[91] Consequently, this collaboration with UoS accords Rolls Royce an opportunity to gain insights from materials research that can be used to further enhance these hypersonic technologies. This prospect also raises a key point: advancements in one EDT can drive progress in advancing other EDTs. Yet, hypersonic weapons pose several risks,[92] including the lack of regulation under extant arms control frameworks and the potential to spark a destabilizing arms race among the nations seeking to acquire these technologies.[93]

Furthering the development of hypersonic air and space vehicles is an example of the many applications of advanced materials. Yet, it is precisely such diverse applications that necessitate transparency of academic research in this field and other EDTs; particularly given that the applications of advanced materials vary substantially in terms of their ethical implications. Applications of materials such as titanium range from benign uses such as civilian engineering and construction,[94] to more ethically dubious uses such as developing missiles.[95] Due to this, a project to make more affordable titanium with the involvement of UoS and a few arms companies, including MBDA,[96] which is a prominent missile manufacturer that derives 99% of its revenue from arms sales,[97] warrants scrutiny and concern. Therefore, maximizing transparency of R&D into this technology and other EDTs can alleviate anxieties regarding the potentially problematic applications of advanced materials. Yet, transparency is necessary but insufficient to pursue ethical research. Safeguards should also be implemented to prevent the weaponization of such technologies.

90 ibid 2018
91 Rolls Royce 2022. Delivering the future of UK Hypersonic capabilities. https://tinyurl.com/bdduzs64
92 For more information on the risks and dangers of hypersonic weapons and academic contributions to these weapons, see Ajonye, O. 2024. “Strathclyde University: Navigating the Murky Waters of the Military Industrial Academic Complex”. CAAT, Demilitarise Education.
93 McWhinney, M. 2020. The risks of hypersonic weapons. Ploughshares. https://tinyurl.com/2ydxde7p
94 Hitoshi et al. 1994. Application of Titanium to Construction and Civil Engineering. Nippon Steel Technical Report 62.
95 wm (undated) Military uses of titanium. North Steel. Shaanxi North Steel Company. https://tinyurl.com/esxssmhh
96 The University of Sheffield 2023. Low-cost Titanium Armour for Land Based Defence Platforms. Royce at the University of Sheffield https://tinyurl.com/yujbckf7
97 Béraud-Sudreau, L. Choi, Y. Liang, X. Scarazzato, L. Tian, N. Da Silva, D.L. Sild, E.K. 2023. The SIPRI Top 100 Arms-Producing and Military Services Companies, 2022. Stockholm International Peace Research Institute. Fact Sheet. p.9

Resistance and Alternatives

Desecuritise Education

The vast and publicized relationships of UoS with the arms trade has led to a series of protests from students and faculty, including the occupation of several buildings.[98] UoS was provided with information by Horus Security Consultancy Ltd about a student group called Solidarity Slate, which made several demands including the university cutting ties with the arms industry.[99] Information provided to the university included the names of six students involved in the group, which reportedly made one of the students feel as if they were under surveillance.[100] UoS was also revealed to have hired a private investigator from Intersol Global to investigate two students who were involved in one of the student occupations regarding the students' alleged violation of the university's regulations, yet both students asserted that they weren't on campus at the time of the protest.[101] One of the students reported experiencing worsening depressive thoughts due to the investigation, while the co-director of movement building from People and Planet argued that such investigations interfere with the proper functioning of the students' learning and studies.[102]

The surveillance of students in response to protests... treats universities and student activism as potential security threats, and frame universities as spaces that need to be closely monitored in order to prevent state subversion

The surveillance of students in response to protests illustrates the broader phenomenon of the securitisation of universities, which, similar to migration as previously described, treats universities and student activism as potential security threats. Such views frame universities as spaces that need to be closely monitored in order to prevent state subversion and even violent radicalization, and in the UK, such securitisation has been driven by the government's Prevent programme.[103] Thus, the capacity of universities to be incubators of radical ideas and movements can make universities objects of suspicion from security officials as well as proponents of the status-quo; prompting various extraordinary measures and even militarised responses. These can include militarised policing in response to student protests, but also other measures such as monitoring and interrogating student activists, outsourcing security functions to external private organizations, and the sharing of student records between universities and government agencies.[104] Such responses illustrate that universities should not just be demilitarised, but also "desecuritised".

Desecuritisation consists of shifting away from treating issues as security threats and instead addressing them within the democratic public sphere.[105] For universities, this will involve eliminating restrictive security measures and surveillance and reclaiming universities as spaces for open inquiry, discussion, and critique of established ideas, which can allow students to fully embrace the purpose of academia: to benefit from intellectual development and stimulation. Satisfying this aim includes fostering dialogue and internal mechanisms for addressing student grievances. For example, during the wave of campus protests in the U.S. in 2024, Northwestern University reached an agreement with student

98 The Sheffield Tab 2022. Sheffield students are occupying The Diamond to protest the uni working with arms companies https://tinyurl.com/3t6kf7mm. Kowhai, P. 2022. Sheffield students occupied the Hicks Building in solidarity with striking lecturers. The Sheffield Tab. https://tinyurl.com/y7dtbz73. Gregory, S. 2023. Students seize Arts Tower to protest Sheffield University links with arms manufacturers. Now Then Magazine. https://tinyurl.com/3arket57

99 Hyde, N. 2023. University criticised for using private investigators to gather information on students. The Yorkshire Post. https://tinyurl.com/5d27hrmd

100 ibid 2023

101 Hall, R 2023. Sheffield University criticised for hiring private investigator after protest. The Guardian. https://tinyurl.com/bdcp236y

102 ibid 2023

103 Sheffield UCU (undated). Understanding Prevent. https://tinyurl.com/2sc68bxp

104 Giroux, H. 2009. The Politics of Higher Education and the Militarized Academy after 9/11. Journal of Comparative Politics 29. pp.104-126, p.115

105 Buzan, B. Waever, O. Wilde, J. 1998. Security: A New Framework for Analysis. (Lynne Rienner Publishers, London) p.4.

protestors to reestablish an advisory committee on investments.[106] Regarding research, university faculty committees have been a platform for deliberating ethical issues arising from external research funding; including when such funding originates from the military-industrial complex.[107] Such fora can also platform and address student demands. By embracing such measures, universities can not only reduce tensions with their student bodies but also stimulate student participation in the deliberation and formulation of academic policies. Furthermore, by taking student demands seriously and permitting them to shape decision-making in the university, universities can also empower and prepare students for political participation in the broader society. This can lead universities to become spaces for students to develop skills for civic engagement, rather than being institutions to merely develop expertise for the military-industrial complex and other industrial sectors. The following sections outline items that could be on the agenda for discussions among concerned faculty, students, and the university administration.

Universities can become spaces for students to develop skills for civic engagement, rather than being institutions to merely develop expertise for the military-industrial complex

General and Complete Disarmament

The devastation caused by the Typhoon and F-35 powerfully evinces the immense civilian harm and insecurity that can be inflicted by conventional weapons systems such as combat aircraft. Accordingly, these conventional weapons systems deserve the same regulation and activism as those that have been directed at controversial weapons such as autonomous weapons systems and nuclear weapons. Initiatives to regulate and reduce conventional weapons systems have been previously pursued at the UN-level. Article 26 of the UN Charter tasks the UN Security Council (UNSC) to develop plans to regulate armaments in order to "promote the establishment and maintenance of international peace and security with the least diversion for armaments of the world's human and economic resources",[108] which has been interpreted to mean "ensuring for all states defensive capabilities at the lowest possible level of armaments".[109] This task entrusted to the UNSC is emblematic of the broader goal of General and Complete Disarmament (GCD). However, the UNSC has long neglected this responsibility,[110] so the Strategic Concept for the Removal of Arms and Proliferation, or (SCRAP) Weapons, based in the School of Oriental and African Studies University in London (SOAS), has taken the initiative in developing a draft framework for regulating armaments. The Framework outlines conditions for documenting and reducing conventional weapons systems such as combat aircraft.[111] Disseminating and engaging with this framework should hence be an urgent task for peace activists, students, and academics.

GCD is part of a larger process of disarmament which aims to not only regulate all armaments but also reduce military expenditures. However, one obstacle to reducing military expenditures is the unavailability of civilian alternatives to secure the livelihoods of those involved in military production. Securing this transition to non-military production has historically been the mission of "economic conversion".

106 Foody, K. 2024. Northwestern University's deal with student protesters offers example of successful negotiations. AP News. https://tinyurl.com/yeynx79e
107 Kistiakowsky, V. 1989. Military Funding of University Research. The Annals of the American Academy of Political and Social Science. Volume 502. pp. 141-154. p.152
108 Charter of the United Nations and Statute of the International Court of Justice 1945. p.7 https://tinyurl.com/78zmbrsc
109 Finaud, M. 2016. Reconciling national security and general and complete disarmament. In (Eds.) United Nations Office for Disarmament Affairs. Rethinking General and Complete Disarmament in the Twenty-First Century. United Nations. p.30
110 Burroughs, J. 2016. Legal aspects of general and complete disarmament. In (Eds.) United Nations Office for Disarmament Affairs. Rethinking General and Complete Disarmament in the Twenty-First Century. United Nations. p.15
111 Framework for a Treaty on General and Complete Disarmament (undated) SCRAP Weapons. https://tinyurl.com/39nzb887

Economic Conversion

Economic considerations are among the factors that supersede ethical considerations in the arms trade, which leads arms-supplying states such as the UK to overlook the unethical and illegal use of arms exports by recipient countries such as Saudi Arabia and Israel. A similar dynamic occurs in military or dual-use research and the career choices available to science, technology, engineering, and mathematics (STEM) students. Academics who hold reservations with the ethics of various military technologies may set aside such concerns to either accept or apply for military-industrial funding due to the financial stability offered by such opportunities.[112] Similarly, STEM-educated students that are otherwise averse or uncertain about careers in the military sector often feel pressured to accept such work if civilian alternatives are unavailable.[113] Economic conversion, which is an economic transition away from military production to nonmilitary production, has historically functioned to resolve this dilemma, which is faced not only by researchers and students, but also by workers as previously shown, by providing civilian alternatives to military manufacturing, research, and careers.

One example that offers an insight into how such civilian alternatives can emerge is the "Ventilator Challenge", which was launched during the early stages of the COVID-19 pandemic in 2020. A consortium of 33 companies, including major arms companies such as Rolls Royce and BAE Systems,[114] responded to the UK government's "Ventilator Challenge" to rapidly manufacture and deliver ventilators to hospitals in the UK.[115] The AMRC, through its association with the HVMC, played an influential role in this challenge by developing HoloLens augmented reality (AR) headsets, which is another Industry 4.0 technology, to enable this consortium to transition to manufacturing medical devices.[116] Originally developed for commercial purposes, HoloLens has faced controversy over its military applications,[117] so the AMRC's experience shows how this technology can alternatively be used to transition away from military production. Other countries like Israel followed a similar approach with arms companies repurposing military technologies, such as radar sensors, to take readings of patients,[118] and rapidly converting a missile factory to make ventilators.[119] The Ventilator Challenge however represents a significant break with the past in which, given the absence of an arms industry in national economies, civilian manufacturers would temporarily pivot to manufacturing weapons, or "swords", during national defence emergencies as described by the late former U.S. President Dwight D. Eisenhower in his farewell address.[120] In this sense, by mobilizing arms companies to instead temporarily manufacture civilian medical equipment during a public health emergency, the Ventilator Challenge implies that arms manufacturers are deeply entrenched in national economies, but the Challenge also reveals that the arms industry is not as irreversible as it seems. Ultimately, retrenching the arms industry and reallocating resources towards peaceful, civilian-oriented, and environmentally sustainable industries is achievable given the requisite investment, willpower, and political opportunity structures.

112 Richburg, J.B. 1985. "Star Wars" Sparks New Campus Debate. The Washington Post. https://tinyurl.com/yn7dkw7e
113 Ajonye, O. 2024. Arms Industry Student Opportunities. Demilitarise Education. p.21
114 BAE Systems (undated). AirCare Ventilator: A tribute to our employees. https://tinyurl.com/mr4d85p9
115 Catapult Network. (undated) Ventilator Challenge UK Consortium. https://tinyurl.com/2s3f4vyh
116 University of Sheffield. Advanced Manufacturing Research Centre 2020. Rising to the Challenge. https://tinyurl.com/cvcv582s
117 Carrie, J. 2019. "We won't be war profiteers: Microsoft workers protest $48m army contract". The Guardian. https://tinyurl.com/2tf9m94u
118 Shpigel, N. 2020. Missiles Out, Ventilators In: Israeli Defense Contractors Answer the Coronavirus Call. Haaretz. https://tinyurl.com/55yb85fs
119 Tress, L. 2020. IAI, Defense Ministry, Inovytec convert missile factory to produce ventilators. The Times of Israel. https://tinyurl.com/4kmjcu2b
120 National Archives 1961. Milestone Documents. President Dwight D. Eisenhower's Farewell Address 1961. https://tinyurl.com/4nybnfvm

The relative success of the Ventilator Challenge in the UK has been attributed to, among other factors, a strong partnership combining businesses, governments, and trade unions, which has been put forward as a model in response to other crises such as the climate crisis and the arms race.[121] However, the experience of Bremen, Germany, reveals the value of including academia in this partnership. Bremen was highly dependent on military production and involved in activities such as producing components for Tornado and Typhoon aircraft, but academics collaborated with local government, businesses, and activist union-organized working groups to discuss, promote, and implement proposals for civilian products, and academic debate and discussion was instrumental in familiarizing the local government with the concept of economic conversion.[122] This starkly demonstrates how researchers play a role in the policy making process as "policy entrepreneurs", who are "energetic actors who engage in collaborative efforts in and around government to promote policy innovations",[123] often in anticipation of opportunities that may arise which can incentivise the adoption of such policy innovations, which in the case of Bremen arose in 1990 following looming post-Cold War declines in military spending.[124] Similarly, academia in the UK and beyond can conduct and promote research into economic conversion in response to challenges such as pandemics, climate change, and declines in military spending. In contrast to the Ventilator Challenge, which represented a "top-down" government-led approach to economic conversion[125] the Bremen case study represents a successful "bottom-up" grassroots-led approach[126] that can be adopted to drive conversion efforts.

Bremen was highly dependent on military production... but academics collaborated with local government, businesses, and activist union-organized working groups to discuss, promote, and implement proposals for civilian products

Furthermore, the fact that components for weapons systems such as the P8 Poseidon, Typhoon, and F-35 are manufactured in several countries illuminates the web of global supply chains that constitute the arms trade. UK officials even invoked these global supply chains as a reason for excluding components for the F-35 from the list of suspended arms licenses to Israel.[127] The internationalization of the arms trade reflects, amongst other interests, the arms industry's concern with minimizing R&D costs, which are achieved when arms companies engage in joint ventures, such as the F-35, to share the R&D costs among all the companies involved (this occurs despite considerable government support for covering the arms industry's R&D expenses).[128] These cost-saving globalization measures played a key role in countering the momentum towards disarmament and conversion that was generated by reduced military spending at the end of the Cold War.[129]

Following from this, opposition to the arms trade must be similarly global in scope. Like climate activists, peace activists must "think global and act local" by advocating for reduced military spending and implementing economic conversion at the local level while linking these local actions to international disarmament efforts such as GCD. This connection can be bolstered by transnational collaboration and coordination among peace activists, concerned academics, organized labour, and policymakers to share resources, research, and strategies. For example, academics, organized labour, and civil society groups from countries involved in the manufacture of combat aircraft such as the F-35 can collaborate on research and activism centered on GCD. In another example,

121 Parkinson, S. 2021. From arms, planes and racing cars to ventilators: industrial conversion during the covid-19 crisis. Scientists for Global Responsibility. https://tinyurl.com/2p9ckus7
122 Pace, B. 2018. Defence Diversification: International Learning for Trident Jobs. Nuclear Education Trust. p.12, 13
123 Mintrom, M. 2019. So you want to be a policy entrepreneur? Policy Design and Practice 2 (4) pp. 307-323. p.307
124 Pace, B. 2018. Defence Diversification: International Learning for Trident Jobs. Nuclear Education Trust. p.12
125 Austin, P. 2020. From Violence to Ventilators: Does arms conversion start here? Rethinking Security, For a Just and Peaceful World. https://tinyurl.com/mr3ke2db
126 Pace, B. 2018. Defence Diversification: International Learning for Trident Jobs. Nuclear Education Trust. p.14
127 Wintour, P. 2024. UK suspends 30 arms export licenses to Israel after review. The Guardian. https://tinyurl.com/ysrjmtk2
128 Grillot, S. Stohl, R. 2009. The International Arms Trade (Polity Press). p.38
129 Bitzinger, R. 1994. The Globalization of the Arms Industry: The Next Proliferation Challenge. International Security 19(2) pp.170-198. pp.173-174

due to the shared involvement of Bremen and Lancashire in manufacturing components for Typhoon fighter aircraft, academics from these regions have a foundation for joint collaborative research exploring opportunities for, obstacles to, and lessons learned from economic conversion, while comparing and contrasting their respective experiences. Academics with similar transnational connections should also seek out opportunities for joint research and collaboration. An example of transnational activist and labour organizing can be seen in the case of Workers in Palestine, which formed in response to a call from Palestinian workers to stop arms transfers to Israel.[130] Scholars and activists can establish or participate in comparable transnational networks to foster collaboration to strategically plan for disarmament and economic conversion.

Student protest at University of Sheffield, 6 March 2013

130 Workers in Palestine (undated). https://tinyurl.com/mupd2uda

Conclusion and Recommendations

UoS plays a role in the MIAC by collaborating with the military and arms companies on workforce development, automation and robotics, and emerging technologies. The aerospace technologies serviced by these collaborations have enabled the arms industry to be more competitive and accrue profits, but have contributed to militarised global apartheid, injury, and massive losses of civilian life. Conventional weapons systems also offer no use value to the public and fail to address the most immediate and pressing needs of society. Nonmilitary sectors, on the other hand, offer tangible benefits such as improved healthcare outcomes and shelter and safety, and hence address daily challenges such as poverty and health insecurity. By pursuing disarmament and reorienting academic and industrial resources to civilian and peaceful industries,a harmonious balance of moral rewards to civilian populations and material well being in society can be achieved, which will also relieve the burden on researchers, students, and workers who feel that involvement in the military-industrial complex requires compromising their ethical values for economic security.

The following recommendations are intended to engage faculty, students, civil society, and the university in addressing the impact of UoS's participation in the MIAC.

By pursuing disarmament and reorienting academic and industrial resources to civilian and peaceful industries,a harmonious balance of moral rewards to civilian populations and material well being in society can be achieved

Recommendations for faculty, students, and civil society

- Utilize research, advocacy, and effective and strategic communications to inform the public and policymakers of GCD and economic conversion.
- Researchers, activists, labour, and policymakers should build transnational networks in support of GCD and economic conversion.

Recommendations for universities

- Relevant academic departments in STEM disciplines should incorporate topics related to the ethics of working in the arms industry and other controversial sectors into their curricula.
- Create platforms to directly engage with students on issues related to the military-industrial presence on campus.
- Establish and instruct the following committees to address the separate challenges posed by military-industrial involvement in universities.
  - Advisory committees for investment, including the administration, students, faculty, and civil society, to review and advise on university investments.
  - Faculty committees to oversee projects funded by the military-industrial complex in order to ensure they are transparent and align with ethical principles.
  - Alternative-use committees, including the administration, and faculty from disciplines most impacted by military-industrial funding (i.e. science, technology, engineering, and mathematics), to devise and promote civilian applications of military research and technology.

Recommendations for students

- Employ the dED Treaty and database as a framework for implementing an ethical transformation of the university.

CAMPAIGN
AGAINST
ARMS
TRADE

dED
demilitarise
education