Military R&D: Is it helping or hindering our security?

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Scientists for Global Responsibility
Scientists · Architects · Engineers · Technologists

SGR
Promoting ethical science, design and technology

http://www.sgr.org.uk/

Presentation at Dept of Sociology, Lancaster University, 25 February 2014

We will talk about...

- UK security landscape
- UK military research and development
- Key justifications for military R&D
- Six key problems of military R&D
- Reconsidering security
- *Start with quick review of SGR's work in these areas...*

Scientists for Global Responsibility research up to 2010

- 'Soldiers in the Laboratory' (2005)
    - Detailed report on military sci/tech, especially in UK (and links to US), incl. funding, lobbying, ethical & political issues
- 'Scientists or Soldiers?' (2006)
    - Ethical issues and potential for alternative careers
- 'More Soldiers in the Laboratory' (2007)
    - Assessed new UK government/ industry military programmes
- 'Behind Closed Doors' (2008)
    - Examined growing military involvement in UK university sector
- 'Science and the Corporate Agenda' (2009)
    - In-depth report including chapters on military corporate sector and fossil fuel industry
- *Chris Langley, lead researcher*

Other SGR activities include education work – including presentations to academics, peace campaigners, and students; articles in specialists media etc – and advocacy work with SGR members and other campaign groups on issues related to military involvement in R&D

References: Langley (2005; 2006); Langley et al (2007; 2008); Langley and Parkinson (2009)

Latest SGR research

- 'Offensive Insecurity' (2013)
  - Authors: Stuart Parkinson, Barnaby Pace, Philip Webber
  - Assessment of shift in recent UK security policies
  - Detailed new programme-level data on UK military R&D
  - Detailed new programme-level data on R&D on tackling the roots of conflict

• Policy shift seen in National Security Strategy and Strategic Defence and Security Review – both in 2010

• Detailed military R&D data using freedom of information (FOI) requests

• Detailed civilian R&D data from publicly accessible databases and FOI requests

• Parkinson et al (2013)

UK security landscape

UK is major military power

- UK military budget is world's 4th largest
- UK is one of 5 'declared' nuclear weapons states
- UK forces active in recent major conflicts
  - e.g. Afghanistan (2001-14), Iraq (2003-7), Libya (2011)
- UK is home to world's 3rd largest arms company
  - BAE Systems
- UK is 6th largest arms exporter
  - Recent recipients include Algeria, Bahrain, Libya, Saudi Arabia, Tunisia, Yemen

• UK military budget was $60.8 bn in 2012 – world's 4th largest behind USA, China and Russia
• UK military spending per person: more than 2 times that of Russia; more than 10 times that of China
• UK spending per person/ per unit GDP is much larger than EU average
• UK nuclear weapons stockpile being reduced to 180 warheads, each with the explosive power 8 times that of a Hiroshima bomb
• UK is home to world's 3rd largest arms company – BAE Systems
• UK is 6th largest arms exporter behind USA, Russia, Germany, France and China

Main references: Stockholm International Peace Research Institute (2013); Parkinson et al (2013); Committees on Arms Export Controls (2011).

Key government policy papers

- DCDC Global Strategic Trends papers (2010+)
- National Security Strategy (2010)
- Strategic Defence and Security Review (2010)
- National Security Through Technology (2012)
- Defence Equipment Plans (2012+)

• These outline UK government policies (and military input to those policies), but there are many inconsistencies between the documents, especially regarding which threats are most important.

• DCDC (2010); HM Government (2010; 2010b); MoD (2012; 2014)

Defence Equipment Plan 2013

	10 year budget (£ bn)
Submarines & nuclear weapons - incl. Trident replacement nuclear-armed subs; 5 more Astute Class conventionally-armed subs	38.0
Combat planes - incl. Lightning II & Typhoon fast jets; UAVs (drones)	18.8
Warships - incl. 2 Queen Elizabeth Class aircraft carriers; Type-45 destroyers; Type-26 Global Combat Ship	17.4
Long-range support aircraft - incl. Voyager & A400M for heavy lift, air-to-air refuelling	13.4
Armoured fighting vehicles - incl. Warrior, Scout	13.1
Weapons - incl. missiles, torpedoes and bombs	11.6
Helicopters - incl. Chinook, Apache, Puma and Wildcat	11.2
Contingency funds	8.4
Other programmes	32.4
Total	**164.3**

• Ring-fencing of the military equipment budget while other MoD (and civilian) spending contracting
MoD (2014)

Some observations...

- Government military/ defence strategy based on:
  - High technology, especially 'networked' technologies
  - Prominent role for 'offensive' weapons systems
    - Capability for 'force projection' over long-range
- Major role of military corporations
  - Often monopoly suppliers
- Involvement of scientists/ engineers essential
  - Large budgets for Research and Development

Parkinson et al (2013)

More observations...

- UK faces no conventional military threats
  - NSS: UK is "more secure... than in most of her long history"
- Major failings of 'War on terror'
- Insecurity arising from wider range of sources
  - NSS: UK is "more vulnerable" due to terrorism, cyber attack, industrial accidents, environmental hazards, interruptions to trade etc
- Major cuts in public spending

• The UK is "more secure... than in most of her long history... in the sense that we do not currently face, as we have so often in the past, a conventional threat of attack on our territory by a hostile power"

• 'War on terror' – failure to achieve 'quick, clean' military victories; high civilian casualties; failure to establish stable democracies; failure to tackle terrorism

• Spending cuts mean that it is even more vital to get priorities correct

Source: HM Government (2010)

Even more observations...

- Floods of 2007 and 2014 have highlighted environmental vulnerabilities
- UK flood defence spending well below that recommended by Committee on Climate Change
- Increasing importance of climate change
- Scientists and engineers essential to tackling environmental threats

• UK carbon emissions per head very high

• UK action to tackle climate change cut back

Sources: CCC (2014); CCC (2013)

UK military R&D

Ministry of Defence R&D

- Recent R&D spending: £1.8 bn per year
  - Approx 1/6 of UK Gov R&D spending
  - One of the world's largest funders of military R&D
- Main research arm is Defence Science and Technology Laboratory (DSTL)

• Spending figures from DASA (2013) & BIS (2012) – R&D figures are 2008-11 average

MoD R&D: Top 4 areas

		Public R&D spending 2008-11
1.	Nuclear weapons systems *Warheads; 'Successor' submarines;* *Nuclear propulsion for submarines*	£980m
2.	Strike planes *Typhoon, F-35 Lightning II, Tornado*	£771m
3.	Attack helicopters *Mainly Future Lynx/ Wildcat*	£599m
4.	Unmanned aerial vehicles *'Drones', including Mantis, Taranis*	£195m

Parkinson (2013; 2014)

- All have major role in 'force projection', i.e. offensive
- These are minimum figures due to incomplete MoD data

• Other areas of interest include missile systems, communications systems, warships, cyber-security, body armour, chemical/biological/radiological/nuclear defence, emerging technologies etc
• These are minimum figures – 1/4 of MoD R&D spending not clearly documented at programme level
• In public relations, the 'life-saving' contribution of military R&D projects is often emphasised, e.g. soldier armour, although in practice this is a small proportion.

UK military R&D: main roles

12%

12%

■ Offensive
■ Defensive
■ General

76%
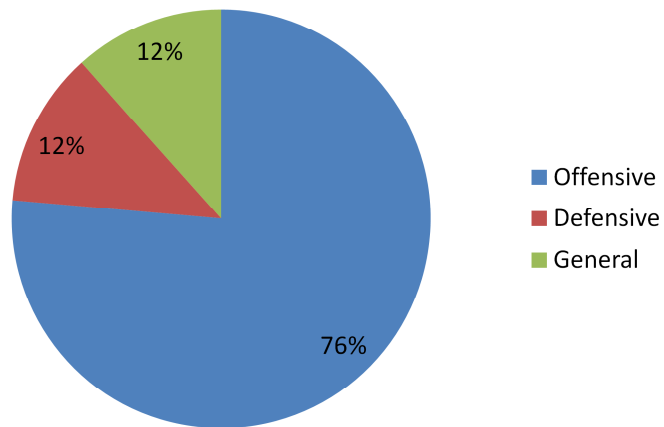
Parkinson et al (2013)

Total military R&D spending, 2008-11: £5.4 billion

• Classifications based on military/ academic literature (more discussion of this later)

Nuclear weapons systems

- Nuclear armed submarines (current)
  - 4 submarines armed with Trident missiles
  - Reduction to 180 nuclear warheads
  - 1 submarine deploys explosive power of 4,000,000 tonnes TNT
- Nuclear armed submarines (future)
  - 3 or 4 submarines armed with Trident missiles
  - Final decision in 2016
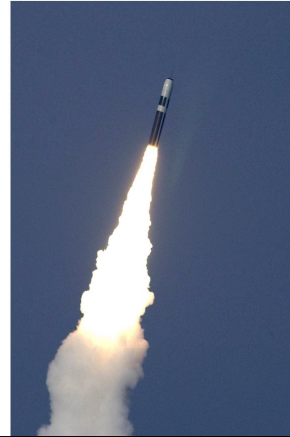
Nuclear armed submarines

- Each warhead has explosive power of 100 kilotonnes TNT (8 times Hiroshima bomb)
- Each submarine can carry up to 40 warheads (4 million tonnes TNT)
- Use of half the weapons on a Trident submarine could cause massive climate disruption – causing global scale famine
- Final decision on replacement of Trident system ('main gate' decision) to be taken by Parliament in 2016

Parkinson et al (2013); Webber (2013)

UK nuclear warhead R&D

- Atomic Weapons Establishment (AWE), Aldermaston
- Major expansion, involving new research facilities
  - Supercomputers; Orion Laser etc
- Collaboration with USA and France
  - New joint research centre with France
- Concern that these undermine nuclear weapons treaties
- R&D spending £100m per year
  - from total budget of £1 bn+

New facilities installed in recent years – details:
• Supercomputers (Blue Oak, Larch etc) – simulation of nuclear explosion
• Orion Laser – small-scale simulation of nuclear detonation, e.g. fusion and boosting
• Materials testing laboratory – to study behaviour of nuclear weapons components
New joint research centres with France – as part of 2010 Teutates agreement
• Joint radiographic/ hydrodynamics facilities – Teutates EPURE at Valduc, France, and Teutates Technological Development Centre at AWE, UK
• Claimed not to be connected to development of new nuclear warheads, but major doubts remain, especially regarding whether they undermine the Nuclear Non-proliferation Treaty and Comprehensive Test Ban Treaty.

Sources:
AWE annual reports and other related documents. http://www.awe.co.uk/
Parkinson et al (2013); Nicholls (2011)

Robotic aircraft/ Drones R&D

- Rapidly developing technology globally
- UK situation:
  - Armed drones first deployed in 2007
  - Collaboration with Israel to develop and deploy
  - BAE Systems: Mantis, Taranis
  - FLAVIIR: R&D involving 10 UK universities, inc. York
- Numerous concerns
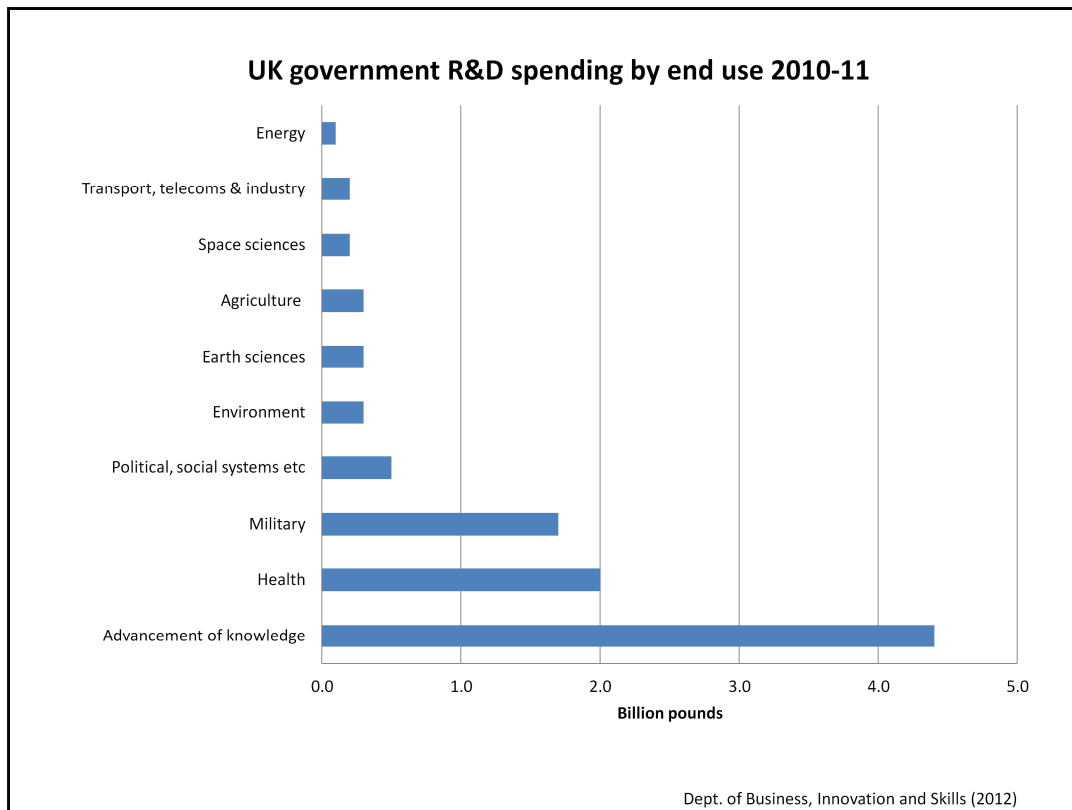 - e.g. proliferation, civilian casualties

UK situation
• Drones initially deployed for reconnaissance, but from 2007 the UK began deploying (US-made) armed 'Predator' drones in Afghanistan. By 31 October 2012, the RAF had carried out 349 drone strikes.
• UK collaboration with Israeli military and arms industry to deploy and develop drones
• BAE Systems developing two armed drones: Mantis and Taranis
• 10 UK universities, inc. York, involved in R&D on drones (FLAVIIR programme) – ran from 2001-06 leading to test flight in 2010
• Ethical issues – see later

Sources: Drone Wars UK (2012, 2012b); Langley et al (2008)
Photo: BAE Mantis (Mike Young)

UK government R&D spending by end use 2010-11

	Billion pounds
Energy	
Transport, telecoms & industry	
Space sciences	
Agriculture	
Earth sciences	
Environment	
Political, social systems etc	
Military	
Health	
Advancement of knowledge	

Dept. of Business, Innovation and Skills (2012)

• Military R&D is spending by Ministry of Defence.

• In the last year, health R&D spending has risen above military R&D for the first time on record.

• Private R&D spending (by arms companies) is smaller and less certain – around a few hundred million pounds (Langley, 2005)

• Further analysis is given later

BIS (2012). Tables 2.4 & 2.2.

International comparison of military R&D

Country	Proportion of total public R&D spending for military purposes	Public R&D spending for military purposes ($bn)
USA	57%	76.7
UK	*17%*	*2.2*
South Korea	16%	2.1
France	15%	2.4
Japan	5%	1.4
Germany	5%	1.3

OECD (2012)

Public funding of military R&D in 2010: comparison of six major nations in the OECD (OECD, 2012)
Base year of 2005, purchasing power parity

Military corporations

- Majority of military R&D (including gov-funded R&D) takes place within industry
  - Represents a subsidy estimated at £500m annually
- UK home to major military corporations
  - BAE Systems
  - Rolls Royce
  - Babcock
  - QinetiQ
  - Many others incl. subsidiaries of foreign companies

• Often, government funds military R&D within industry and then purchases the resulting technology – effectively paying twice (Langley, 2005)
• Estimate of subsidy (Jackson, 2011)
• BAE Systems – world's largest arms company following takeover of several US contractors
• Rolls Royce – specialises in engines for ships, aircraft (2nd largest in UK)
• BAE Systems, Rolls-Royce, Babcock International all part of the consortium to build new nuclear-armed 'Successor' submarines
• QinetiQ – privatised government military labs (7th in UK)
• Aggressive lobbying – sit on many influential advisory committees

Military & UK universities

- Numerous paths for military funding of R&D in universities
  - About £200 million a year, but figures very uncertain
- Government schemes
  - Through military labs, civilian Research Councils etc
- Corporate schemes
  - Large programmes run by Rolls Royce, QinetiQ
- Joint government-industry schemes in recent years
  - e.g. Defence Technology Centres (DTC)

• Government schemes run in conjunction with: Defence Science and Technology Labs (DSTL); Engineering and Physical Sciences Research Council (EPSRC)
• References: Langley (2005); Langley et al (2007; 2008)

Which universities?

- Studies
  - 29 universities, 4 national programmes (2005)
  - 26 universities, mainly Russell Group (2007)
  - 16 universities, random sample (2008)
  - 53 universities with AWE funding (2014)
  - Work mainly carried out by SGR, Campaign Against Arms Trade, Nuclear Information Service

- Are there any without military funding?

Sources: Langley (2005); Street and Beale (2007); Langley et al (2008); Langley (2014)
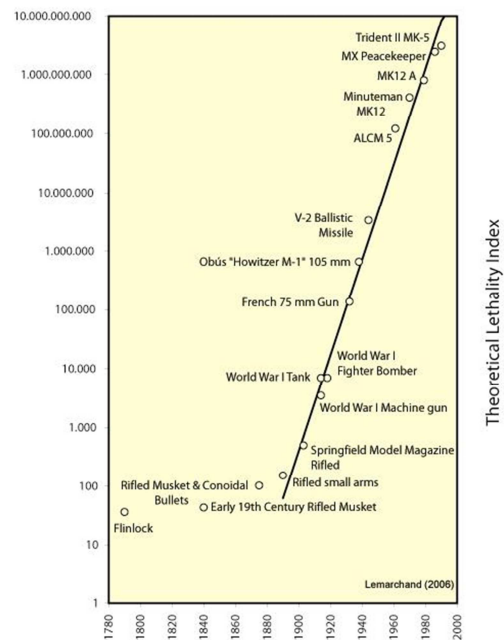
Justifications for military R&D

- Technological/ operational military advantage
  - To 'win wars'
- To protect our soldiers/ reduce casualties
- To deal with emerging/ unknown future threats
- Income from arms sales
- But...

• 20 year time horizon often considered for 'desired' new technologies
• These arguments can be found in, for example, MoD (2012)

Six key problems of military R&D

1. Increase in destructive power of weapons systems

- Theoretical Lethality Index
  - maximum number of casualties per hour that a weapon can generate
- Military R&D has been a key factor in exponential growth in lethality of weapons during 20th Century

Graph labels (y-axis: Theoretical Lethality Index): 10.000.000.000; 1.000.000.000; 100.000.000; 10.000.000; 1.000.000; 100.000; 10.000; 1.000; 100; 10; 1

Weapon points: Trident II MK-5, MX Peacekeeper, MK12 A, Minuteman, MK12, ALCM 5, V-2 Ballistic Missile, Obús "Howitzer M-1" 105 mm, French 75 mm Gun, World War I Fighter Bomber, World War I Tank, World War I Machine gun, Springfield Model Magazine Rifled, Rifled small arms, Rifled Musket & Conoidal Bullets, Early 19th Century Rifled Musket, Flinlock

x-axis years: 1780, 1800, 1820, 1840, 1860, 1880, 1900, 1920, 1940, 1960, 1980, 2000

Lemarchand (2006)

• Theoretical 'Lethality Index' first proposed in 1979 by Colonel Dupuy
• It includes consideration of: rate of fire, number of targets, relative effectiveness, range effects, muzzle effects, accuracy, reliability, etc.
Graph from Lemarchand (2007).

Increase in destructive power =
Increase in casualties in war

War-related deaths

War-related deaths (per 1000 people)
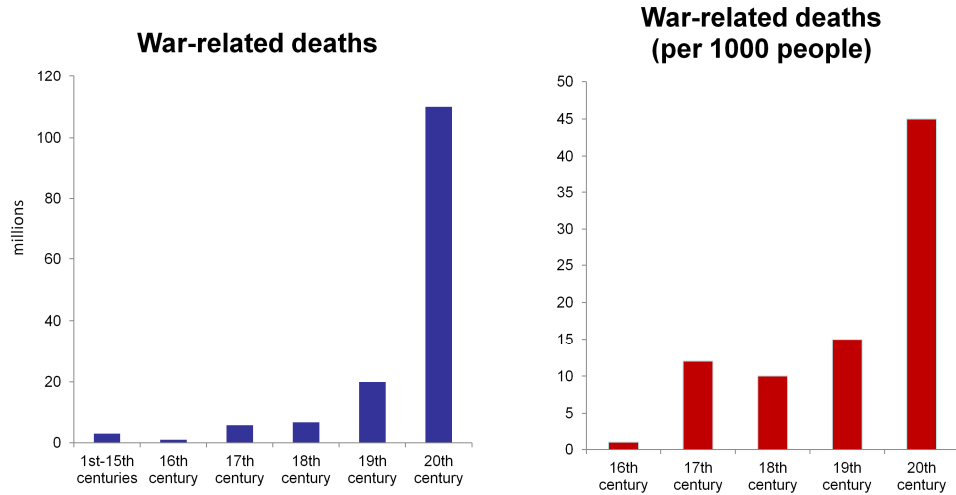
Webb (2005)

2. Contributing to high civilian casualties

Conflict	Percentage civilian
World War I (1914-18)	45%
World War II (1939-45)	70%
Iraq War (2003-11)	At least 79%

Key factors leading to high civilian casualties:
• destructiveness of modern weapons
• targeting of civilians and infrastructure
• low tech responses, e.g. hiding among civilians

Use of modern technology in war has **not** reduced proportion of civilian casualties

A range of different factors have
Total number of deaths:
• World War I – about 15 million (including indirect deaths)
• World War II – about 66 million (including indirect deaths)
• Iraq War – 162,000 (violent death only)
Sources: White (2010); IBC (2012).

3. Failure of 'precision' weapons

- Recent drive to create more accurate 'precision' weapons to reduce civilian casualties
  - Especially missiles launched from aircraft
- Academic/ military research shows casualty rate is no lower (and can be much higher)
- New problems...

Analysis of 'precision' weapons

- Academic study of 14,000+ violent incidents during Iraq War
  - Suicide bombs: 16 civilian deaths per incident
  - Air-strikes: 17 civilian deaths per incident
- Study by US military-linked think-tank in Afghanistan
  - Drone strikes 10 times more deadly than conventional military jets

• Kings College London study: analysis of 14,196 incidents involving 60,481 civilian deaths in Iraq 2003-08 (Hicks et al, 2009)
• Center for Naval Analyses study: analysis of air strikes in Afghanistan from mid-2010 to mid-2011, using classified military data (The Guardian, 2013)

'Precision' weapons: new problems

- Rise of armed drones
  - More frequent use than piloted aircraft
  - Use outside the battlefield by CIA – war crime?
  - Small-scale drones are a particular weapons proliferation threat
  - Future potential for autonomous drones
- Can fuel support for terrorist response

• Rapidly increasing use of armed drones by USA; UK and Israel also leading in deployment and R&D
• Many other countries now have R&D programmes
• Expansion of 'battlespace'
  • More frequent use can increase civilian casualties
  • CIA deployment in Pakistan, outside the battlefield – 'targeted assassinations' – illegal?
• Anger over 'illegal' use is leading to increased support for Taliban/ Al-Qaeda in Pakistan and internationally
• Industry is developing the potential for them to act autonomously
• Sources: Drone Wars UK (2012); Open Briefing (2013); Amnesty International (2013)

4. Driving export/ proliferation of weapons

- To help spread R&D costs, military tech is exported to other nations
- Example: UK exports to Libya
  - Licenses granted for €119m from 2005-09
  - Exports included armoured vehicles, tear gas etc used against uprising
  - Other NATO countries exported combat aircraft, missile systems etc
- Exports of drones technology will fuel international military threat

Figures from the Official Journal of the European Union summarised in The Guardian (2011)

5. Overconfidence in use of military force

- Flawed belief that military technology allows wars to be won quickly and cleanly
- Side effects of war
  – Destruction of infrastructure
  – Unsecured weapons
  – 'Blowback'
- Military R&D fuels arms races
  – Even with allies

• Blowback is the unintended consequences of a military/ covert operation that are suffered by the civil population of the aggressor government or its allies.

6. Opportunity costs

- Financial and technical resources could be used elsewhere
- Science and technology needed to help solve other urgent problems
  - International poverty/ injustice
    - Malnutrition, clean water etc
  - Global environmental problems
    - Climate change; biodiversity loss etc

Reconsidering security

Different approaches

- New security policies
  - Less aggressive military roles
  - Tackling root causes of insecurity
- Changed roles for security-related R&D

Non-Offensive Defence

- Focus military forces on narrowly-defined defence
- Cut the 'offensive' arsenal, especially:
  - Nuclear weapons
  - Long-range 'strike' aircraft, missiles etc
  - Long-range military ships and submarines
- Minimise/ eliminate arms exports
- Shrink the military industry
- Peace-keeping activities would be retained

• Under a Non-defensive defence policy, the armed forces retain the capability to defend national territory (and contribute to peacekeeping), but not to invade or mount a major attack

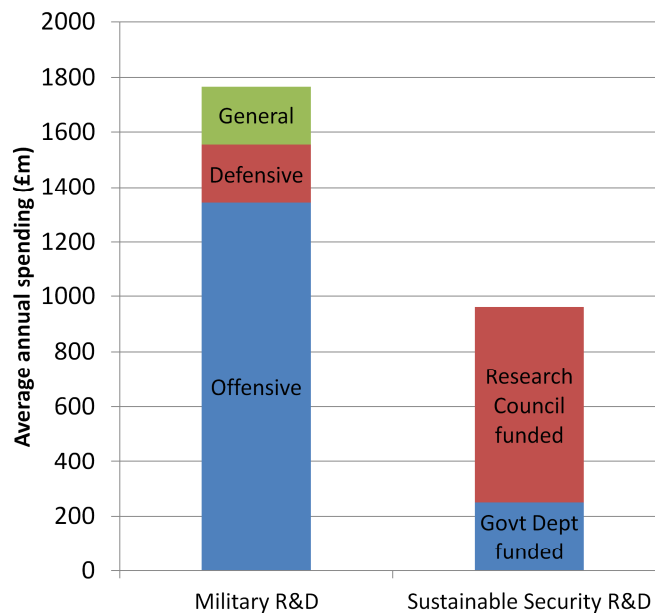• The case for Non-offensive defence (although known under a variety of titles) has been made for decades.

References: Parkinson et al (2013); Webber (1990)

Sustainable Security

- More substantial shift
- Focus on tackling the roots causes of major security threats:
  - Competition over resources
  - Global militarisation
  - Marginalisation of the majority world
    - Economic inequality/ poverty
  - Climate change

Reference: Abbott et al (2006)

Comparing UK security R&D (2008-11)

Military R&D: Offensive, Defensive, General

Sustainable Security R&D: Govt Dept funded, Research Council funded

Average annual spending (£m)

Parkinson et al (2013)

• Sustainable security R&D spending includes: international development and poverty alleviation, climate change impacts, sustainable energy

technologies, food security, international relations, natural resource management, biodiversity, environmental risks and hazards, sustainable

consumption and other measures to mitigate and adapt to climate change.

A change in R&D priorities

- UK public R&D spending 2008-11
  - 2 to 7 times more spent on military than on 'sustainable security'
- New R&D priorities should be:
  - Arms control/ disarmament
  - Tackling environmental problems
  - Economic reform
  - Energy security
  - Food/ water security etc
- ➤ **A major spending shift towards sustainable security is urgently needed**

Parkinson et al (2013)

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