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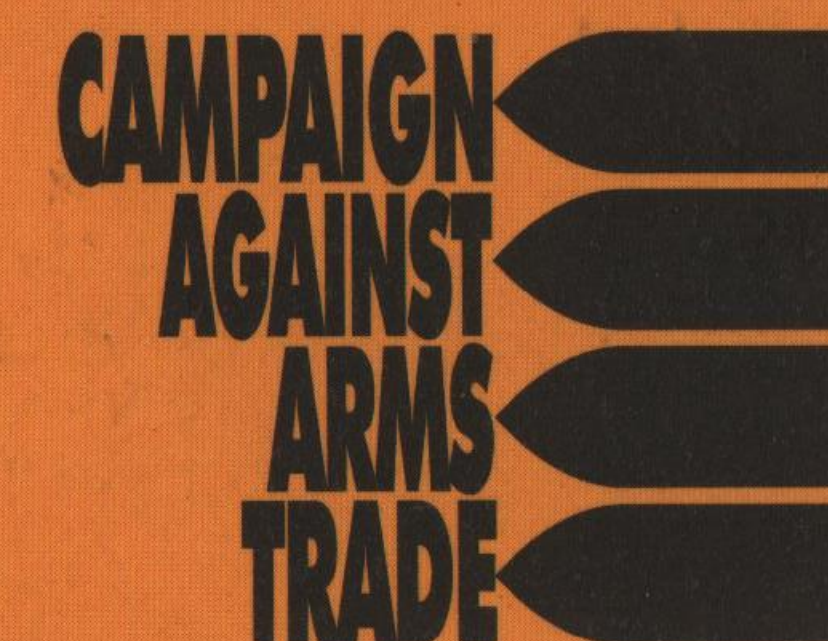
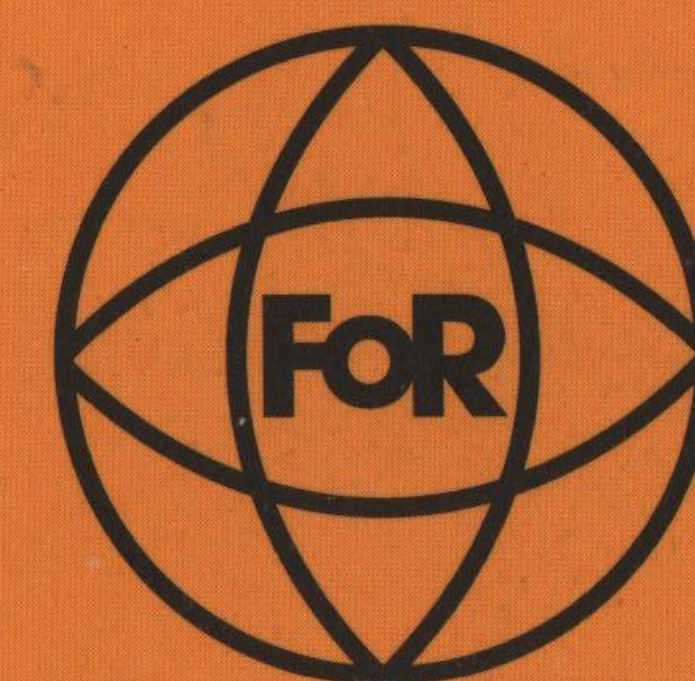
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STUDY WAR NO MORE



**Military involvement
in UK universities**



Study War No More was written by Tim Street with Martha Beale.

Martha Beale, Tim Street and Jo Wittams conducted the research for the report, with the assistance of staff and volunteers from CAAT and FoR.

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Any errors which remain in the report are, of course, our own responsibility.

Martha Beale
Tim Street
Jo Wittams

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Executive summary

Overview

The primary purpose of this report is to supply information about funding provided by military organisations – governmental and industrial – to 26 UK universities between 2001 and 2006. The report ultimately intends to support students and academics concerned about the very real impact their institutions have on international peace and conflict; and to encourage debate regarding the democratic deficit within academic institutions and the ends and ethics of research and research funding. Universities are publicly funded institutions and yet information on military funding of higher education is often not available within the public domain. Where resources do exist, the information is often partial and out of context. As such, we have used the Freedom of Information Act (FoI), internet research and questionnaires in order to create as clear a picture of the relationship between universities and military organisations as possible. Whilst we have striven to uncover as much data as we can, we are keenly aware that the report is a foundation document rather than a definitive record of university-military research. We hope therefore that the report will provoke, inspire and motivate others to continue researching this area, and act as a basis on which people can create, develop and sustain a campaign. With this in mind, the report incorporates other media, with full data for each of the 26 universities covered being made available on the Internet at www.studywarnomore.org.uk.

Methodology

Projects referred to in this report have been designated as 'military,' because they have been sponsored by either i) a public military body e.g. the Ministry of Defence (MoD) and/ or ii) a private military company e.g. BAE Systems. Public military bodies such as the MoD and its research establishment (including AWE, DERA and Dstl) have budgetary remits and mission statements which focus on the production and procurement of military technology. Similarly, all the private military companies used in the data for this report are in the top 100 companies in the world judged by military revenue. It is also vital to note the role the Engineering and Physical Sciences Research Council (EPSRC) plays in financially supporting nearly a third of the military projects we discovered.

Conclusions

Military projects at 26 UK universities 2001–2006: Principal findings

- Our research found that between 2001 and 2006, more than 1,900 military projects were conducted in the 26 UK universities covered by this report.¹ In terms of income to these universities, we have estimated the total value of these projects to be a minimum of £725 million.
- Out of the 26 UK universities, those conducting the largest number of military projects were, in descending rank order: Cambridge, Loughborough, Oxford, Southampton and University College, London.
- Three powerful multinational companies were involved as the sponsors/ partners of over two-thirds of identified military projects at the 26 UK universities. These companies are: Rolls Royce, BAE Systems and QinetiQ.
- The UK government's military research establishment – including Ministry of Defence (MoD), Defence Science Technology Laboratory (Dstl), Defence Evaluation Research Agency (DERA) and Atomic Weapons Establishment (AWE) – was involved in a quarter of all military projects at the 26 UK universities.
- Over half of all military projects at the 26 UK universities are conducted in university engineering departments, with the rest spread over other science and technology departments.

Military funding and influence at UK universities

Our research shows that the military sector – both governmental and industrial – has been able to push its way into UK universities through funding a variety of projects, mainly involving research. By sub-contracting research to universities, which have world-class, publicly-funded staff and facilities, the military sector can keep overheads down and, in the case of military companies, profits up. The ease with which military organisations can influence university departments, through purchasing research and services and providing sponsorship, is indicative of the general trend towards commercialisation in higher education. The hundreds of projects conducted between 2001 and 2006 for the military sector at the 26 UK universities indicate that the military has,

in particular, built up strong levels of influence over science, engineering and technology departments.

Public subsidies for military research

Public money, mainly from the Engineering and Physical Sciences Research Council's collaborative research grants scheme, heavily subsidises many of these military projects, in particular those conducted by military companies, which contribute relatively small amounts of money. The public financing of military research makes these projects more attractive to universities, especially those suffering from funding shortfalls. Academics thus accept and actively seek out military money because they are under pressure to attract research funding to their department. Moreover, because the university funding system has been used by the government to introduce policies which promote research with economic benefits to industry, science, engineering and technology departments' funding options have narrowed. Academics may also be more willing to accept military funding if they do not perceive the work to be military. This may be because they don't associate the research they are being paid to conduct with a direct military application. This is despite the fact that it is often possible to identify work which has been paid for by military that either have very high military revenues or spend millions of pounds on military production and/ or procurement.

Researching military funding at UK universities

Our report found that in spite of the Freedom of Information Act, accessing data regarding the funding of universities by the military sector (for example from university and research council websites in addition to FoI requests) is time-consuming and only presents a partial picture of the actual economic relationships. Two reasons for this – apart from the fact that institutions are often not compelled to provide such information – are the need for commercial confidentiality between competing organisations (including universities) and the cloak of secrecy surrounding the military sector. Without full transparency in the future, including clear and easily accessible information concerning how public money is used to support projects conducted by the military sector, it will not be possible to accurately assess the extent of military involvement in UK universities or monitor developments and trends.

Recommendations

The following recommendations are primarily for students, academics, staff and alumni of UK universities who wish to see fewer university departments depending on and accepting military funding and an increase in the exploration of civilian alternatives. More detailed information on researching and

campaigning can be found on our website: www.studywarnomore.org.uk.

Transparency, Accountability and Democracy

The first step towards challenging the dependence of UK universities on funding from military organisations is to ensure that information regarding this relationship is publicly available so that it may be freely discussed. Transparency can only be achieved through the use of the media, public debates, meetings and campaign groups to press for change within universities and government. Ultimately, the decision-making structures of universities and government must change if the military sector's research agenda is to stop being pushed onto university departments and there is to be a reduction in the amount of military projects conducted at UK universities.

Recommendations and actions:

1. Seek out and publicise military funding at your university

Activists should utilise the Freedom of Information Act and the information available on university and research council websites to investigate their universities' ties with the military sector. It is also important that academics and other staff members lend their weight to student campaigns, help students find out departmental information and liaise with university authorities.

In order to share and disseminate this data as widely as possible, student media, unions and other societies and groups should be informed of any findings relevant to their institution and activists should make their concerns known to the wider community regarding the external funding of universities.

2. Lobby for democratic change within your university and government

Once activists have information regarding military funding at their university, they can use a variety of tools to campaign for an end to military influence. For example, activists could create a campaign website and literature outlining the military funding at their university, why they oppose it and what they recommend as an alternative. Goals could include:

- The creation of a central register (including data provided by the government) of all university ties with military and/ or industrial funders to include funding sources and any other industrial connections.
- That academics should be required, for example on their departmental web pages, to state the funding they have

taken from external organisations, what this funding was for and who provided it.

- The establishment of an ethics committee whose members could include university managers e.g. the Vice-Chancellor, academics, students and representatives from industry, to review research with military applications.
- Establishing links with other universities in order to lobby universities for the above changes and government for a reprioritisation of public support away from military

projects and towards civil and socially useful projects at UK universities.

- Where necessary, academics should reject funding from projects with military sponsors and/ or with likely military applications and seek alternative work which provides civil benefits to society, for example, by helping to address social and/ or environmental problems.

Foreword

Global military spending has been increasing steadily over the past five years, reaching a massive \$1.2 trillion (£0.6 trillion) for 2006, a figure likely to be an underestimate, especially as it's difficult to obtain reliable figures from countries engaged in conflict. This seemingly inexorable increase has been largely due to the so-called 'War on Terror' and related conflicts in Afghanistan and Iraq. The USA government is responsible for the lion's share of this global spend and its funding of military research and development (R&D) is expected to reach an astounding \$78 billion (£39 billion) in 2007, a 57% increase since 2001.

The UK, which sees itself as a global military power, also spends significant amounts of tax payers' money on military R&D, currently around £3 billion from the Ministry of Defence alone. Military spending in the UK looks set to increase over the next five years. The growth of weapons-based 'defence' in the UK and its reliance on science and engineering has been set out in the Ministry of Defence's Defence Industrial Strategy (DIS) and the Defence Technology Strategy (DTS). The latter, launched in 2006, marks an expanded effort to involve universities more deeply in military R&D, by seeking, through the government's Defence Science and Technology Laboratory and the recently privatised QinetiQ, closer relationships with university scientists and technologists in the UK and abroad. Thus universities as centres of such expertise increasingly augment the R&D effort undertaken in UK and US military corporations.

The DIS and DTS also underscore continuing dependence on collaboration with the USA – for example, in the Joint Strike Fighter programme. The many UK-US collaborative activities develop 'interoperability' – the ability of systems, units or forces of the two nations to work closely together to meet military objectives of mutual importance. Such interoperability further strengthens the UK government's commitment to high technology warfare together with a sophisticated infrastructure, whilst stimulating associated spending on R&D. And, of course, it binds the UK more tightly into US foreign policy.

Universities have become, as the result of concerted government 'incentives' over the past twenty years, commercially driven with a vast range of roles to play in supporting 'economic growth' and lending their expertise to profit enhancement. This change from being, in the main, centres of learning and disinterested investigation to 'R&D

contractors' in science and technology, has profound implications for openness and democracy. Corporate interests tend to favour secrecy, a monopoly of intellectual property rights and the silencing of dissidence. Furthermore, the commercialisation of universities can have a negative impact on those subjects which are not supported by big business.

These trends are not good news for those in universities. Studies have shown that bias is often introduced to the objective pursuit of research when commercial partners, such as pharmaceutical and tobacco companies, work with universities. Similar worries must arise when military corporations like BAE Systems are partners with many universities in the UK, as described in this report.

It's instructive to set the military R&D budgets into a wider context. Research which aims to help tackle poverty, climate change and ill-health – and thus help to provide basic security for human populations – is under-funded compared with military R&D. For example, in 2004, industrialised countries spent around \$85 billion on military R&D, but only \$50 billion on R&D for health & environmental protection and less than \$1 billion on R&D for renewable energy. A similar imbalance can be seen in UK spending in these areas.

Military R&D in the industrialised nations supports the so-called Revolution in Military Affairs (RMA), which is dependent upon expensive and highly sophisticated weapons and their support infrastructure. The RMA is a flawed rationale which argues that, in essence, conflicts can be resolved 'cleanly' through the use of hi-tech weaponry. Iraq and to a lesser extent Afghanistan have been conflicts which have showcased the latest high technology weapons from the USA and its current partners. Without the active involvement of scientists, engineers and technologists there simply would be no RMA. But to appreciate the ways in which military research, development and demonstration drives technological arms races like the RMA one needs to look more closely at the various ways in which the R&D process is undertaken. This involves universities, government departments and military corporations forming a complex web of links supportive of R&D partnerships.

Study War No More shows in detail the extent and nature of many of these partnerships. The authors have looked in considerable detail at 26 UK universities and charted the corporate- and publicly-funded programmes of research having actual or potential military objectives. Using the

Freedom of Information Act and considerable perseverance, details of departmental funding and the projects supported are assembled.

In an era of increasing erosion of many of our freedoms in the name of security it is essential to know the extent to which universities are undertaking research which addresses such narrowly-defined goals. Global security needs to be approached from a wider perspective. Some university research takes such an approach, looking for example at conflict prevention – but its funding is negligible in comparison to that devoted to high technology warfare. It's time that we changed this situation.

This report is a must-read for all those contemplating a career in science, technology or engineering and for those of us who believe that social justice, a healthy environment and a sustainable economy, rather than highly expensive and complex military technologies, are the basis of a safe and secure world.

Dr Chris Langley, Scientists for Global Responsibility

Chris Langley is author of the report 'Soldiers in the laboratory: Military involvement in science and technology – and some alternatives' and also the briefing 'Scientists or soldiers? Career choice, ethics and the military'. He co-authored, with Stuart Parkinson and Phil Webber, the update on the militarisation of UK science and technology entitled More soldiers in the laboratory. All are produced for Scientists for Global Responsibility (www.sgr.org.uk) as part of an ongoing study of the military influence within science, engineering and technology. He has worked for over twenty years in science policy and the communication of science and medicine, and currently runs ScienceSources, an independent consultancy, which offers access to and advice about issues within science, engineering and technology and their communication.

Introduction

The primary purpose of this report is to provide information about the funding of UK universities by military organisations, both governmental and industrial. The report also intends to support students concerned about the impact their institutions have on international peace and conflict; and to encourage debate regarding the democratic deficit within academic institutions and the ends and ethics of research and research funding. Universities are publicly funded institutions and yet information on military funding of higher education is not always within the public domain. Where information does exist, it is often partial and out of context. Therefore, we have used the Freedom of Information Act (FoI), internet research and questionnaires in order to create as clear a picture of the relationship between universities and military organisations as possible.

Our research identified two main elements to this relationship: firstly, direct funding of research conducted by university departments in partnership with, or on behalf of, a military organisation (this form made up the majority of cases); secondly, military-related projects such as student and staff sponsorship, donations and the funding of events. Our report considers how much influence military organisations have over research priorities and to what extent public money

is supporting the development of military technology and the profits of arms companies. We have also provided a contextual analysis of the current political and economic realities facing higher education and the military sector.

Throughout the writing of the report, we have sought to balance the large volume of data collected with an approachable, useful and flexible format. As our work evolved it became increasingly clear that there was no definitive 'end' to the gathering of data, a factor which shaped the presentation of the report. Therefore, while we have striven to uncover as much information as possible, we are keenly aware that the report is a foundation document rather than a definitive record of university-military research. We hope therefore, that the report will motivate others to continue researching this area, and act as a basis on which people can create, develop and sustain a campaign. With this in mind, the project as a whole encompasses other media, with full data for each of the 26 universities covered being made available online at www.studywarnomore.org.uk. We hope campaigners will identify further data that can be linked from the website to create a collaborative record of military funding of research and development within UK universities.

Section 1: Methodology

In 2006, 26 UK universities were approached with FoI requests asking for data concerning the funding they received from military organisations. Twenty universities² were chosen as members of the Russell Group, an association of research-intensive universities which boasts of securing “65% (£1.8 billion) of UK Universities’ research grant and contract income”.³ The remaining six⁴ were included to provide a geographical spread across the United Kingdom and, in the cases of Cranfield University and Loughborough University, to include institutions known to have strong connections to the military sector. It must be made clear from the outset that this report does not cover all military projects at all UK universities, but rather, due to constraints of time and resources, seeks to examine many of those universities most likely to have conducted the greatest number of projects.

Further data was assembled from university websites, annual reports, press statements, departmental reports, financial statements, research council websites, media outlets and questionnaires sent to academics. We sought to utilise all sources of data, and to reveal the extent to which this supposedly public information is in fact hidden or obscured. To focus our research, we limited the time period examined to six years (1st January 2001 to 31st December 2006) and only included those projects which were funded by organisations we defined as military.

Military and non-military organisations

Projects referred to in this report have been designated as ‘military’ if the source/ sponsor/ partner of the project included either i) a public military body, e.g. the Ministry of Defence (MoD) and/ or ii) a private military company, e.g. BAE Systems. Public military bodies such as the MoD and its research establishment (including Atomic Weapons Establishment, Defence Evaluation Research Agency and Defence Science Technology Laboratory) have budgetary remits and mission statements which focus on the production and procurement of military technology. Similarly, all the private military companies used in the data for this report, are in the Top 100 companies in the world by military sales. This method is complicated by the fact that there are a number of military projects with both military and non-military sponsors and/ or partners. Non-military organisations⁵ can, as with military organisations, be split into two groups: i) Public non-

military bodies, e.g. Engineering and Physical Sciences Research Council (EPSRC) ii) Private non-military industry, e.g. Airbus.

These two non-military groups have quite different reasons for funding projects alongside military organisations. For example, the EPSRC is one of the UK’s seven Research Councils and thus a publicly funded non-military body – yet was the sponsor/ partner of nearly a third of all military projects identified by this report. The EPSRC jointly funds research with military organisations as part of its mission to support technology transfer from universities to industry (e.g. BAE Systems) and governmental research related to national defence capability (e.g. Ministry of Defence). As such, the EPSRC’s contribution to military research at UK universities is an important factor in determining the current university-military relationship, and is referred to throughout the report.

Private non-military industry (such as Airbus) funds projects with military sponsors/ partners, due to the nature of research conducted within universities, where work is often basic (rather than applied) and can thus have several applications. Non-military companies therefore have an interest in the outcome of research at this early stage as it may be applied to purposes other than military ones. Because this report is only concerned with military projects, private organisations which do not have significant military revenues and are not in the Top 100 companies in the world according to revenue from military sales, have not been referred to or included in the data presented by this report.

Types of military projects

As described above, the term ‘military project’ is used in this report to refer to projects that have sponsors whose interest is primarily military or which have high revenues from military sales. However, some projects are more obviously likely to have military applications than others. Many projects have titles that specifically indicate the production of knowledge for military technology. If the project title does not clearly provide this kind of military link, we can then look to the project’s sponsors. If a project has sponsors which are concerned exclusively or almost exclusively with military matters, such as the MoD or BAE Systems, it is extremely likely that the knowledge generated by the project is intended to have a military application. Where sponsors have a mix of civil and military interests, clearly there is the possibility that

it is intended to meet civil ends although in this situation the project could also be geared towards both civil and military applications. Similarly, as university research is often of a basic nature, a project may result in having a military application that was previously unforeseen.

Because of this, the decision on whether to include a project was taken on a case by case basis, as we considered it of the utmost importance to only use data from those projects that are either explicitly military or where the knowledge generated has a strong possibility of being used by the sponsoring organisation’s military division (whilst recognising that it is impossible to account for each project’s ultimate use). In order to determine whether this possibility is strong enough, the latter category considered the military output of the organisation in question. For example, university research projects conducted for a company with civil as well as military production – such as Rolls Royce – have been included because the company received 30% (\$4,000 million) of its annual revenue from military sales in 2006.⁶ Thus the two terms, defined below and used throughout this report to describe the military projects conducted by universities, should be read with this consideration in mind.

1. Military research projects

The vast majority of projects (70%) covered in this report concern military research, whereby a university is contracted by one or more military organisations to conduct a specific research project in order to provide new technical knowledge. An example of a military research project at Bristol University is given below.

Table 1.1 – Military research project: Bristol University

Department: Aerospace Engineering			
Source/ Sponsor/ Partner	Project	Amount	Date
EPSRC, BAE Systems Operations Ltd, QinetiQ Ltd	Unsteady Aerodynamics Simulation by Flight Control System Integration with Structure-Coupled CFD	£148,562	Oct 2002 – May 2006 ⁷

What is military research?

The UK military sector mainly comprises the Ministry of Defence (MoD) and the military corporations. The MoD requires not only new and better weapons, but whole systems of support and surveillance to achieve ‘technological superiority’ on the battlefield. The military corporations rely on the MoD wanting to buy such military equipment, as they need customers for their military produce. As Professor Keith Hartley of York University’s Centre for Defence Economics explains:

“Production of such weapons requires both research and development. Research precedes development and generates new technical knowledge which is then applied to the development of new equipment. Development involves engineering design, manufacture and testing which might result in the eventual production of the equipment for the Armed Forces.”⁸

Universities primarily work in the initial stages of the military production cycle. They are attractive as outsourced research centres for the military sector, as they are cheaper and have high quality facilities and expertise. Furthermore, whilst in-house R&D must be firmly results-focused and subject to commercial confidentiality, academic R&D is open to innovation and collaboration.

Research applications – military or non-military?

Whilst it is common sense to assume that university research paid for by the military sector will have military applications, it must be noted that the ‘dual-use’ of basic scientific research means it is often impossible to definitively designate a research project as military or non-military. Furthermore, because all companies listed as a source/ sponsor/ partner for a project in this report undertake both civil and military work to varying degrees, attempting to define the university projects that they sponsor as being ‘military’ is a potentially complex and difficult task.

To take one example, Rolls Royce (which our research revealed to be the organisation involved in the largest number of military projects at UK universities between 2001 and 2006) has several civilian businesses, but also received 30% (\$4,000 million) of its annual revenue from military sales in 2006.⁹ Whilst we do not have access to information that would reveal how Rolls Royce uses the work produced by a university project it has funded, we cannot ignore the fact that a significant proportion of the company’s work is geared towards generating profits from military sales and therefore may have many military applications for basic research. The likelihood of a university research project sponsored by Rolls Royce having military applications is increased if, as frequently occurs, an organisation with very high military

output, such as BAE Systems, partners Rolls Royce in the project.

Moreover, several academics questioned as part of this report, raised the issue of their discipline's indivisible connection with the military sector. One such scientist said:

"Virtually all materials science research has at least some potential implications for military usage. It's therefore virtually impossible for anyone in the materials science field to take a principled stand against doing any work with a possible military application."

This statement is important, not just for what it reveals about material science research, but for what it tells us about university research as a whole. The scientist quoted above defends academics who conduct research funded by the military on the grounds that they very often cannot know for sure what the end-use of their work will be. Because 'virtually all' of materials science research is described as having 'at least some potential for military usage,' it is 'virtually impossible to take a principled stand against doing any work with a possible military application.' However, as described above, it is often possible to identify research with either a definite or strong possibility of having a military application, by looking at the project title and project sponsor. By no means all university research falls into the category of having 'at least some potential' or 'possible' military applications, for we can reasonably judge that work with an explicitly military project title, or a project sponsored by an organisation with high military procurement or production will have military usages. If this is the case, then academics who do not wish to conduct work with military applications can use this method to judge each project on its merits.

2. Military-related projects

Military-related projects are all those identified projects that are not focused on producing research for a military organisation. Types of military-related projects funded by military organisations include: student and staff sponsorship (e.g. studentships, chairs, bursaries, prizes, scholarships, fees and grants), industrial placements, conferences, benefactions, consultancies, careers and graduate fairs, travel grants and teaching programmes. To give a few specific examples, Edinburgh University received money from arms companies including BAE Systems, Thales and QinetiQ, as well as the Ministry of Defence, to pay for several 'Undergraduate Scholarships,' and 'Tuition Fees' for students, which were individually worth between £1,000 and £5,000 a year. University College, London meanwhile, received money from Thales Defence Ltd, Smiths, EADS Astrium, BAE Systems and QinetiQ, for a variety of 'Studentships' and 'Short Courses,' mostly worth under £5,000, between 2001 and 2006.

Forms of funding

UK universities receive money for a military project from either a single funder or from a group of funders. Projects with a single funder involve, for the most part, a project partner which is either a public or private military organisation. There are a few instances where public, non-military organisations, such as the EPSRC, are the sole funders of a project, but these are rare occurrences. Usually the EPSRC partners public military and/ or private military organisations in sponsoring military research.

For projects with multiple funders, there are several possible combinations of the three organisation types which sponsor and/ or partner the project. Furthermore, there can be as few as three or as many as 25¹⁰ organisations participating in a project. Projects involving multiple partners can be categorised as follows:

1. Public – e.g. EPSRC, MoD, University of Oxford
2. Private – e.g. BAE Systems, Rolls Royce, University College, London
3. Public-Private – e.g. EPSRC, BAE Systems, University of Southampton

Collecting the data

Whilst we have sought to cover as many sources of information as possible to create the most accurate portrait available, a combination of factors (e.g. military secrecy and commercial confidentiality) have prevented us revealing the actual extent of military funding within many of these institutions. Several of the problems encountered during the researching of this report are discussed in the 'Case Study' in Section 3.2, which focuses on the data for the University of Bristol. There was a huge disparity in the amount and quality of data in the FoI replies we received from universities responding to the same original request. This was exacerbated by the fact that much of the data proved incomplete due to limitations on the amount of information universities were prepared to provide free of charge; also requested data proved to be inaccessible due to system updates, institutional takeovers and storage of information.

In addition to genuine problems with data-retrieval and the sheer volume of data we had to sort through, universities had very different attitudes to the provision of information. Many universities were unfamiliar with and had inadequate provisions for FoI. Some omitted funding later revealed by other sources (such as the university's own website), or led us to believe they had provided all relevant information when we later found data proving that this wasn't the case. While

legislative requirements created a lengthy process for FoI requests, this was exacerbated by a small number of universities which, on occasion, appeared to abuse FoI regulations. Unfortunately this small number appeared to take our requests as personal criticisms rather than legitimate appeals for information and transparency.

The research also revealed a vast disparity among university websites; and problems within them. These included: data on

research grants and contracts lost with the ever-changing nature of websites; funders left unacknowledged, contradictions between information found within university and departmental web pages and between information found within university and funding council websites, and direct access prevented by security-enabled zones. The website with most clarity and transparency proved to be that of the Engineering and Physical Sciences Research Council which revealed project titles, dates, amounts and investigators.

Section 2: UK military R&D and university funding

To gain a sense of the importance of military funding to UK universities from an economic point of view – and vice versa – it is necessary to explore the budgets of the organisations funding military projects at UK universities and the income of the UK university sector. As discussed in Section 1, the funders of military projects at UK universities include military organisations such as the Ministry of Defence (MoD) and military companies as well as non-military organisations – primarily the Engineering and Physical Research Council (EPSRC).

Whilst detailed budgetary data for the MoD and the EPSRC is widely available, this is not the case with the budgets of the private military companies covered by this report – for obvious reasons. Therefore the key statistic missing from Table 2.1 is military industry's annual spend on projects contracted out to UK universities. This is important as military industry conducts much of the MoD's R&D, either in-house in company facilities or through sub-contractors, e.g. universities. Furthermore, it is beyond the scope of this report to scrutinise the budgets of all the 26 UK universities featured here, and so general figures for the university sector (obtained from government statistics) have been used.

Table 2.1 – UK military R&D

UK military spend 2005/06	£30.0 billion ¹¹
UK military R&D spend 2005/06	£2.4 billion ¹²
Estimated MoD R&D spend with industry 2005/06	£2.1 billion ¹³
Annual MoD R&D spend with universities	£20 million ¹⁴

UK military spending

In 2006, global military expenditure exceeded \$1.2 trillion,¹⁵ nearly half of which was spent by the United States.¹⁶ The UK military budget is now the second highest in the world with recent spending of £30 billion in 2005/06 making the UK a major military power. In 2006, the UK was also the third largest arms exporter globally,¹⁷ and is home to several military corporations in the Top 100 companies (according to military

revenue) in the world, including BAE Systems (3rd), Rolls Royce (16th) and QinetiQ (36th).¹⁸

UK military research and development

Ministry of Defence

Approximately 30%¹⁹ of the total public funds for UK R&D are spent by the MoD, making the United Kingdom the world's second highest funder of military R&D after the US. The MoD spends taxpayer's money on R&D, mainly to assist its various contractors to develop what is later bought by the Ministry. As shown in Table 2.1, in 2005/06 approximately £2.4 billion was spent by the MoD on UK R&D,²⁰ of which an estimated £2.15 billion²¹ was spent on "extramural R&D" work which is mostly contracted out to military industry. The rest of the MoD's annual R&D budget (£300-£400 million) is spent on research undertaken in its own research establishments which spend "approximately £20 million per year on research with academia."²²

Table 2.2 – MoD's top 6 direct suppliers in 2004/5²³

£1 billion BAE Systems
£500–700 million QinetiQ, General Dynamics UK
£300–500 million MBDA UK, Rolls Royce, Westland Helicopter (Finmeccanica Group)

Military companies

As described above, the MoD mostly contracts out its R&D to industry, which is a small group of companies constituting the MoD's key suppliers as shown in Table 2.2. These companies are given R&D contracts to develop equipment which they either conduct in their own laboratories or sub-contract out to other organisations e.g. university departments.

Table 2.3 – world ranking by military revenue of the top five industry funders of UK university research²⁶

Company	World rank	2006 total revenue (\$ million)	2006 military revenue (\$ million)	% of revenue from military sales
Rolls Royce	16	14,008	4,062	29
BAE Systems	3	26,968	25,071	93
QinetiQ	36	1,983	1,513	76
GKN Group	40	6,797	1,376	20
Thales	11	13,599	6,997	51

These military companies (many of which are amongst the largest in the world, see Table 2.3 for the world ranking of the top university funders) are also in the lucrative business of exporting arms, which generate large profits as the R&D for this equipment has, to a large extent, already been paid for by the MoD. Thanks to the support of the UK Government, "UK companies continue to consolidate Britain's position as the second largest defence exporter, with a 20% share of the global market."²⁴

Interestingly, the MoD's Defence Technology Strategy tells us that, "the level of UK aerospace industry self-financed R&D in the civil sector in 2005 was approximately 6% of its £10.5 billion turnover. However, its self-financed R&D in the defence sector was only approximately 2% of its £12.2 billion turnover. This should be compared with the UK MoD's total R&D investment of over 8% of the defence budget."²⁵ This further supports the idea that military industry is benefiting enormously from the MoD's high military budget and R&D spend, as the taxpayer is shouldering the costs and risks of military R&D.

Unfortunately, commercial confidentiality means that there are no publicly available figures detailing exactly where military companies' R&D money comes from and where and how it is spent (for example, on in-house research and/ or sub-contracts e.g. to universities). However, we do know from the 2003 Lambert Review of Business-University Collaboration commissioned by HM Treasury, that business and industry is the fifth largest source of research funding for UK universities.²⁷ In 2000–1, for example, UK industry spent £259 million on research in UK universities – 7% of their total research income. We also know that Aerospace and Defence is the second largest R&D sector in the UK, being dominated by BAE Systems and Rolls Royce as is illustrated by Table 2.4 below. From this it would be reasonable to suppose that the Aerospace and Defence sector plays a leading

Table 2.4 – aerospace and defence R&D spend 2005/06²⁸

Company	R&D spend
BAE Systems	£1,110 million (3rd largest R&D investment in the UK)
Rolls Royce	£282 million (9th largest R&D investment in the UK)
Smiths	£137 million
Cobham	£49 million
Westland	£12 million
Thales Optronics	£1 million
VT	£1 million

role amongst industrial funders of UK university research and, in all likelihood, funding in general.

The Engineering and Physical Sciences Research Council (EPSRC)

The EPSRC is the main UK government agency for funding research and training in engineering and the physical sciences. It invests in a broad range of subjects – from mathematics to materials science, and from information technology to structural engineering. Table 2.5 shows that in 2004/05, the EPSRC's net budget for R&D in UK universities was £480 million, the largest amount of the seven publicly funded UK

Table 2.5 – UK research councils

UK research council budget 2005/06	£2.4 billion ²⁹
Net government expenditure on EPSRC R&D 2004/05	£480 million ³⁰
EPSRC Net Research Grant Expenditure 2004/05	£309 million ³¹
EPSRC Industry Collaborative Research Grants 2004/05	£124 million ³²
Annual Industrial Contribution to EPSRC Research Grants	£43 million ³³
EPSRC Annual Spend – Academic projects in the military sector	£35 million approx. ³⁴
MoD Annual Investment in EPSRC Joint Grants Scheme	£5 million ³⁵

Research Councils. 40%, by value, of the research grants the EPSRC funded at universities in 2004/05 involved industry collaboration, which amounts to £124 million worth of research.³⁶ Industry itself contributes £43 million to these collaborative grants, which seems low compared to the public contribution and lower still when the figure is broken down.

According to the EPSRC's 2004 Sector Report on Defence and Aerospace,³⁷ (the sector conducting the lion's share of military research), industrial collaboration "attracts around £9 million cash and £34 million of in-kind contributions from industry." In terms of money alone, for the £35 million spent by the EPSRC to support research grants which ultimately benefit the military sector, the companies themselves only put in £9 million. With regards to military industry, the Sector Report describes how the EPSRC spends "an average of £35 million every year on academic projects in the Aerospace and Defence sector," and that industry collaboration is "dominated by the large multinational companies, BAE Systems and Rolls-Royce, with the newly privatised QinetiQ in third place." That such a high proportion of industry's overall contribution to these collaborative grants is not monetary, should be borne in mind when studying the figures for these military companies' contributions given in Table 2.6.

Whilst Table 2.6 shows that Rolls Royce, BAE Systems and QinetiQ funded 188 grants at UK universities (which presumably equates to a significant proportion of the 336 "active collaborative relationships"³⁸ the EPSRC has with industry) we do not know how much of these grants given to universities is "in-kind" funding and how much is "cash," or

Table 2.6 – 'EPSRC Key Industrial Collaborators'³⁹

Company	Total grant value (£ million)	Number of grants
Rolls Royce Plc	7.4	90
BAE Systems	5.8	62
QinetiQ Ltd	2.7	36

precisely when and to whom these grants were given. However, the fact that these military companies are collaborating with the EPSRC on such a large number of projects at UK universities – whilst contributing relatively low cash sums – indicates how beneficial this relationship has been to them.

The Joint Grants Scheme

As Table 2.7 shows, the MoD also invests in a number of collaborative research grants at UK universities with the EPSRC to the tune of £5 million per annum. Furthermore, it is described by the EPSRC's 2004 Sector Report on Defence and Aerospace to be "currently collaborating on 153 research projects."⁴⁰ MoD collaboration with the UK research councils, such as the EPSRC, is conducted through the Joint Grants Scheme, in order to support research which has 'defence relevance'. Representatives of the interests both of government and of the MoD are linked to the Joint Grants Scheme. These representatives come from bodies such as the Defence Science and Technology Laboratories (Dstl) and the Atomic Weapons Establishment (AWE Aldermaston). The Joint Grants Scheme provides funding for science in a variety of areas including: materials, DNA pathogen sequencing, smart materials and a wide range of nanotechnology and 'cutting edge' research. This is to ensure, as the EPSRC's 2003–07 Strategic Plan

Table 2.7 – Funding provided by the Joint Grants Scheme to UK universities⁴²

Year	No. of grants	Value in £,000
1999	43	5,100
2000	61	4,600
2001	41	4,650
2002	34	4,780
2003	31	5,600

states, "research related to national defence capability will remain a significant input to EPSRC's research agenda."⁴¹

UK university finance and funding

As student numbers continue to increase in line with the government's target to get 50% of young people into university by 2010, universities face a shortfall in their budgets – estimated by the Association of University Teachers (AUT) at being over £2 billion for 2003/04.⁴³ Furthermore, a 2003 study by the Sutton Trust highlights how Britain's record for winning Nobel prizes has fallen because its universities are under-funded. The study compares the UK's funding of universities to other nations, describing how, "The US spends 2.7% of its GDP on higher education compared with an OECD average of 1.3%, and a UK spend of just 1%."⁴⁴ The study goes on to describe how twenty years ago, "the UK spent the equivalent of £10,000 per student on university tuition, whereas it now only spends £5,100."⁴⁵

The central argument of the 2003 Lambert Review of Business-University Collaboration, is that in order for universities to attract external funding and close the funding gap, they should be responsive to the needs of business and industry. In the review's introduction, university laboratories are praised for being "constantly refreshed by the arrival of clever new brains."⁴⁶ Universities' success in these areas makes them "very attractive partners for business," for, crucially, they are "unlike corporate or government owned research facilities." Furthermore, the UK's business research base is "both narrow and fragile and heavily dependent on the investment decisions of a dozen large companies mainly involved in pharmaceuticals and defence." The Lambert Review therefore makes it clear that business can alleviate the economic and commercial pressures of global competition by outsourcing research to university departments, which can be used without meeting the full costs. In doing so, companies can close their own research laboratories thus increasing their businesses' profitability. Chris Langley, in his *Soldiers in the Laboratory* report of 2005, describes this process of university privatisation, which has restructured the university sector over the last two decades, in the following way:

"Thus through the combination first of cuts and then of specifically directed initiatives and inducements universities have increasingly turned to the commercially focused area which includes both the industrial corporations and various kinds of public-private partnerships."⁴⁷

Central to the development of a 'knowledge economy,' are universities' science, engineering and technology departments.

The Department of Trade and Industry (DTI)⁴⁸ will spend at least £178 million per year by 2007/08⁴⁹ on collaborative R&D and knowledge transfer networks. The fact that public spending on science has become intrinsically tied to industrial targets and private wealth creation, is demonstrated by the millions of pounds of public money the EPSRC spends annually on projects which ultimately benefit military industry (see Table 2.5). Such programmes have been facilitated by advisory bodies and industrial lobbying groups as well as favoured 'spokespersons' from military industry which now inform decisions on public policy regarding higher education and the nation's science, engineering and technology agenda. The National Defence Aerospace and Systems Panel (NDASP) is one such advisory body which military companies use to influence university science. Its remit is to "Establish a coherent programme of focused UK aerospace and defence research and technology demonstrators, involving government, industry and academia."⁵⁰ As of 2001/02, its members included representatives from government research establishments, universities and leading arms companies such as BAE Systems, GKN Westland, Rolls Royce and Thales.⁵¹

The economic significance of the military funding of UK universities

It is difficult to give a precise sense of the economic importance of military funding to the budgets of UK universities for several reasons. Firstly, as discussed in Section 3.2, the total value of the military projects we discovered is an estimated minimum. Furthermore, whilst we have a figure of £20 million a year for the value of the R&D contracts the MoD places with universities, we do not know the total value of the projects that military companies sub-contract to the university sector. As described above, because the MoD contracts out much of its R&D to military companies, a significant amount of this will end up being sub-contracted to universities. This situation is further complicated by the fact that the MoD and military industry fund collaborative research projects with the EPSRC, so that military projects receive funding from both military and non-military organisations.

What we can conclude from the available statistics is, firstly, that the bulk of funding for UK university research comes from public money, for example through the funding and research councils and government departments, and that, as the Lambert Review points out, private industry funding i.e. direct corporate grants to universities, constitutes a relatively small proportion of their total research budget – £259 million or around 7% as of 2000/01. Importantly, the Aerospace and Defence (Military) sector must be a significant contributor to

this figure, given the fact that it is the second largest R&D sector in the UK and, as our findings for this report show, highly values the university sector's research capacity for its future technological production. Secondly, the UK government spends billions of pounds of public money a year on military R&D, which is mainly contracted out to a few key military companies. Thirdly, our findings show that the majority of military projects conducted at UK universities involve private military industry, and that many of these projects benefit from public support through collaborative grants from the EPSRC.

To summarise, whilst military companies annually sponsor hundreds of military projects at UK universities, and benefit hugely from the resulting knowledge, the financial benefits to universities are not perhaps as significant as might be expected. For example, the military sector consistently records massive annual profits, with the total R&D spend for BAE Systems being over £1 billion and for Rolls Royce over £0.25 billion in 2005/06. But their annual contributions to the EPSRC's collaborative grants programme – of £5.8 million and £7.4 million respectively – are relatively small, particularly considering that not all of the money given to the EPSRC for industrial collaborations are paid in cash, but largely constitute “in-kind” contributions, which presumably means goods, commodities and services.

In order to understand the relatively low value of military industry's R&D spend with the university sector compared to the large number of projects they are involved in, we must consider the high level of direct and indirect taxpayer support that military companies receive – money which effectively subsidises the projects they conduct with universities. In theory, military industry could conduct a similarly large number of projects at UK universities without public support, at a lower level of funding. However, questions remain as to why military industry receives such a degree of financial support from the government, given its vast annual profits and the fact, as shown in Section 3, it conducts many projects at UK universities without the support of the taxpayer. For example, direct funding comes from the MoD's R&D contracts – which mostly go to industry – and indirect funding comes through the EPSRC's collaborative industry grants scheme. Of course, there are further economic benefits to military industry from outsourcing work to universities, because these institutions contain some of the world's best

infrastructure and most accomplished scientists, a position only achieved through decades of public funding.

Therefore, the economic importance of military projects being conducted at UK universities lies in the many benefits to the military companies that contract out this work and therefore influence the research agenda. This is in contrast to the expense that the public incurs in subsidising them and the relatively small amount of income the university sector receives. Despite this, UK universities have built strong links with military companies and place great importance on securing their investment and partnership on departmental projects. To understand the rationale behind this, we must consider how the corporate sponsorship of research operates within university departments as a source of power – as Nick Hildyard, author of *Scientific Research for Whom?* explains:

“Corporate funding brings financial security to a project, conferring an “importance” which it might otherwise not deserve, and enhancing the status of the researcher within the department. By a perverse logic, the capacity to “bring in” corporate funds becomes a route to promotion – with the result that key administrative posts within universities and research institutes have come to be dominated by those who share industry's priorities. Indeed, because corporate funding enables researchers to leverage matching funding from governments, even small amounts of corporate funding have a disproportionate influence on the wider orientation of public research. In effect, through the strategic placing of research grants, industry is able to direct public funds into research that best serves its interests.”⁵²

This is certainly true of military industry, as can be seen from the EPSRC's (and, for that matter, the UK government's) stated policy of supporting large multinational military companies such as BAE Systems, Rolls Royce and QinetiQ, which have developed a disproportionately powerful say in universities' research agendas. Furthermore, the government's university funding policies have made attracting industrial research funding crucial for departmental survival. Academics (particularly in science, engineering and technology departments) therefore seek out contracts from the military sector because, in doing so, they receive economic and political benefits under the current funding system.

Section 3: Data and analysis

This section contains information on the military projects conducted by the 26 universities covered in this report between 2001 and 2006. Section 3.1 outlines the number and value of military projects for each university, showing which departments conduct and which organisations fund military projects at these UK universities. Section 3.2 is a case study of the University of Bristol, which is used as an example of how the data for each university was collected, what it means and what problems were encountered, such as in the interpretation of project data. Section 3.3 provides examples of several major university-military projects and Section 3.4 gives an insight into academics' views of the military funding of universities. Full data covering all of the military projects identified for each of the 26 universities covered by this report between 2001 and 2006 can be found on our website: www.studywarnomore.org.uk.

Section 3.1: Military projects at UK universities 2001–2006

Defining military projects

The term ‘military project’ is used in this report to refer to projects that have sponsors whose interest is primarily military or which have high revenues from military sales. However, some projects are more obviously likely to have military applications than others. Many projects have titles that specifically indicate the production of knowledge for military technology. If the project title does not clearly provide this kind of military link, we can then look to the project's sponsors. If a project has sponsors which are concerned exclusively or almost exclusively with military matters, such as the MoD or BAE Systems, it is extremely likely that the knowledge generated by the project is intended to have a military application. Where sponsors have a mix of civil and military interests, clearly there is the possibility that it is intended to meet civil ends although in this situation the project could also be geared towards both civil and military applications. Similarly, as university research is often of a basic nature, a project may result in having a military application that was previously unforeseen.

Because of this, the decision on whether to include a project was taken on a case by case basis. We considered it of the utmost importance to only use data from those projects that are either explicitly military or where the knowledge generated

has a strong possibility of being used by the sponsoring organisation's military division (whilst recognising that it is impossible to account for each project's ultimate use). In order to determine whether this possibility is strong enough, we considered only the military output of the organisation in question. For example, university research projects conducted for a company with civil as well as military production – such as Rolls Royce – have been included because the company received 30% (\$4,000 million) of its annual revenue from military sales in 2006.⁵³ The data presented below should be read with this consideration in mind.

NB Endnotes explaining irregularities in the data have been provided as necessary.

Summary

- Our research found that between 2001 and 2006, more than 1,900 military projects were conducted in the 26 UK universities covered by this report.⁵⁴ In terms of income to these universities, we have estimated the total value of these projects to be over £725 million.
- Out of the 26 UK universities covered in our report, the top five, conducting the largest number of military projects, were: Cambridge, Loughborough, Oxford, Southampton and University College, London. These universities account for 40% of the identified university military projects, the total value of which is estimated as over £139 million.⁵⁵
- Cranfield University was clearly the largest recipient of funding for military projects with a total of over £380 million. This high total is due to the 22-year contract worth £366 million that Cranfield won in 2006 from the Ministry of Defence in order to educate its service and civilian personnel. This project is singular in its value and size, in that the next most valuable military projects were between £5 million and £30 million.⁵⁶ Sheffield University was involved in the second and third most valuable projects awarded to the 26 UK universities we investigated. These were the €42 million “Technologies and Techniques for New Maintenance Concepts (TATEM)” project sponsored by Smiths, EADS, Thales and BAE Systems⁵⁷ and the £18 million “Advanced Manufacturing Research Centre,”⁵⁸ whose main sponsor was Boeing.

Table 3.1 – military projects at UK universities 2001–2006⁶¹

University	Total number of projects	Minimum amount received from projects ⁶²	Rank (out of 26, by no. of projects)	Top 3 departments (by no. of projects) ⁶³	Top 3 funders (by no. of projects)
Queen's University, Belfast	37	£2,058,946	18th	1) Electrical and Electronic Engineering 2) Mechanical and Aerospace Engineering 3) Civil Engineering	1) BAE Systems 2) Rolls Royce 3=) Qinetiq 3=) EPSRC
Birmingham	59	£11,606,978	13th	1) Metallurgy and Materials 2) IRC in Materials Processing 3) Electrical and Electronic Engineering	1) EPSRC 2) Rolls Royce 3) QinetiQ
Bristol	101	£12,109,941	6th	1) Aerospace Engineering 2) Mechanical Engineering 3) Electrical and Electronic Engineering	1) QinetiQ 2) EPSRC 3) Dstl
Cambridge	283	£42,565,637	1st	1) Engineering 2) Physics 3) Metallurgy	1) Rolls Royce 2) EPSRC 3) QinetiQ
Cardiff	44	£2,860,183	16th	1) Engineering 2) Business School 3) Computer Science	1) QinetiQ 2) MoD 3) Dstl
Cranfield	73	£382,907,327	11th	1) Engineering 2) Applied Sciences 3) Defence College of Management and Technology	1) EPSRC 2) BAE Systems 3=) QinetiQ 3=) MoD 3=) Rolls Royce
Durham	23	£1,606,253	21st	1) Engineering 2) Chemistry	1) BAE Systems 2) EPSRC 3) Dstl

Table 3.1 – continued

University	Total number of projects	Minimum amount received from projects	Rank (out of 26, by no. of projects)	Top 3 departments (by no. of projects)	Top 3 funders (by no. of projects)
Edinburgh	70	£6,963,426	12th	1) School of Engineering and Electronics 2) School of Informatics 3) School of Medicine	1) BAE Systems/ Selex 2=) QinetiQ 2=)Thales
Glasgow	82	£5,262,373	8th	1) Aerospace Engineering 2) Electronic and Electrical Engineering 3) Mechanical Engineering	1) QinetiQ 2) BAE Systems 3) EPSRC
Hull	30	£2,797,261	20th	1) Chemistry 2) Engineering 3) Physics	1) DERA 2=) EPSRC 2=)QinetiQ
Imperial College, London	95	£24,642,446	7th	1=) Electrical and Electronic Engineering 1=) Aeronautics 2) Materials	1) EPSRC 2) MoD 3) BAE Systems
King's College, London	19	£1,092,026	22nd	1) War/ Defence Studies 2) Physical Sciences and Engineering	1=) QinetiQ 1=)EPSRC 2=) BAE Systems 2=) MoD
Leeds	73	£3,856,532	11th	1) CPD Unit/ SPEME 2) Mechanical Engineering 3) Careers	1=) QinetiQ 1=) Rolls Royce 2) BAE Systems
Liverpool	38	£17,581,758	17th	1) Engineering 2) Geography	1) EPSRC 2) BAE Systems 3=) MoD 3=) QinetiQ 3=) Rolls Royce

Table 3.1 – continued

University	Total number of projects	Minimum amount received from projects	Rank (out of 26, by no. of projects)	Top 3 departments (by no. of projects)	Top 3 funders (by no. of projects)
Loughborough	126	£29,206,101	2nd	1) Aeronautical and Automotive Engineering 2) Electronic and Electrical Engineering 3) Manufacturing Engineering and Mechanical Engineering	1) Rolls Royce 2) BAE Systems 3=) EPSRC 3=) MoD
London School of Economics	3	£861,653	23rd	1) Information Systems	1) EPSRC 2) Rolls Royce
Manchester	74	£15,812,903	10th	1) Mechanical Aerospace and Civil Engineering 2) Materials 3) Engineering and Physical Sciences	1) EPSRC 2) BAE Systems 3) Rolls Royce
Newcastle	55	£9,129,147	14th	1=) Marine Science Technology 2) Electrical, Electronic and Computer Engineering 3=) Computer Science 3=) Engineering Design Centre	1) EPSRC 2) BAE Systems 3) QinetiQ
Nottingham	46	£29,133,566	15th	1) Mechanical Materials, Manufacturing Engineering and Management 2) Electrical and Electronic Engineering 3) Mathematical Sciences	1) EPSRC 2) Rolls Royce 3) BAE Systems
Oxford	124	£19,222,724	3rd	1) Engineering Science 2) Materials 3) Computing Laboratory	1) Rolls Royce 2) QinetiQ 3) EPSRC

Table 3.1 – continued

University	Total number of projects	Minimum amount received from projects	Rank (out of 26, by no. of projects)	Top 3 departments (by no. of projects)	Top 3 funders (by no. of projects)
Sheffield	79	£41,886,131	9th	1) Mechanical Engineering 2) Electronic and Electrical Engineering 3) Automatic and Control Systems Engineering	1) Rolls Royce 2) EPSRC 3) BAE Systems
Southampton	119	£43,251,201	4th	1) Electronics and Computer Science 2) Engineering Sciences 3) Optoelectronics Research Centre	1) EPSRC 2) BAE Systems 3) QinetiQ
Swansea	33	£4,571,020	19th	1) Engineering 2) Materials Engineering 3) Civil Engineering	1) Rolls Royce 2) EPSRC 3) BAE Systems
University College London	117	£5,284,072	5th	1) Electronic and Electrical Engineering 2) Mechanical Engineering 3) Mathematics	1) QinetiQ 2) BAE Systems 3) EPSRC
Warwick	46	£1,796,917	15th	1) Engineering 2) Business School 2) Physics	1) BAE Systems 2) EPSRC 3) Rolls Royce
York	59	£7,764,687	13th	1=) Computer Science 1=) Electronics	1) BAE Systems 2) QinetiQ 3) EPSRC

- A small group of three powerful multinational companies are involved as the sponsors/ partners of over two-thirds of identified military projects at the 26 UK universities. These companies are: Rolls Royce, BAE Systems and QinetiQ.
- The UK government's military research establishment – including Ministry of Defence (MoD), Defence Science Technology Laboratory (Dstl), Defence Evaluation

Research Agency (DERA) and Atomic Weapons Establishment (AWE) – was involved in a quarter of identified military projects at the 26 UK universities.

- Over half of the military projects at the 26 UK universities covered in this report, are conducted in university engineering departments, with the rest spread over other science and technology departments.

- In terms of duration and cost, we found nearly half of all military projects to be small-scale, with a value of £100,000 and under. Significantly, our research found 114 large projects, worth over £500,000, which are mainly conducted in a few elite institutions. Military funding over a period of years will therefore be an important budgetary factor for these universities, leading to departmental dependency.
- Over 20% of the military projects we found are fully paid for by the taxpayer e.g. projects sponsored by the MoD. The EPSRC, a publicly funded, non-military body, was involved in part-funding nearly a third of all military projects. Military industry fully paid for 40% of all projects.⁵⁹ 30% of projects received both public and private funding. We were not able to categorise 9% of the projects we found.⁶⁰
- Whilst all but one of the top ten organisations involved in the largest number of military projects at the 26 UK universities covered in this report are UK-based (the exception being Thales of France), 17 US military organisations funded 139 projects at UK universities between 2001 and 2006. The Office for Naval Research, Defence Advanced Research Projects Agency (DARPA), US Air Force, US Army and US Navy accounted for 94 of the 105 projects conducted by US public military organisations. Of the 35 projects sponsored/ partnered by US private military companies, Boeing sponsored 23.

University projects funded by the military sector

Table 3.1 shows the number of projects conducted and their total value for each of the 26 universities (listed alphabetically) covered in our research.

The five universities which we found to have conducted the largest number of military projects are Cambridge, Loughborough, Oxford, Southampton and University College, London. Together, they account for 40% of all military projects conducted at UK universities between 2001 and 2006, worth over £139 million. Furthermore, out of the top ten universities listed in the table above, Loughborough is the only university which is not a member of the elite Russell Group, which, in 2004/05, accounted for 65% (over £1.8 billion) of UK Universities' research grant and contract income. Table 3.2 shows a similarly strong correlation between those UK universities which annually receive the most research income and those universities shown by our data to have conducted the largest number of projects funded by military organisations between 2001 and 2006.

Table 3.2 – top 10 UK universities by total research income 2004/05⁶⁵

University	£ million
Cambridge	270.7
Oxford	263.2
University College, London	248.9
Imperial College, London	248.3
Manchester	191.5
Edinburgh	148.1
King's College, London	144.0
Southampton	113.8
Sheffield	113.5
Leeds	111.0

Whilst Cranfield had the 11th largest number of projects – with 74 being conducted between 2001 and 2006 – it was clearly the largest recipient of funding for military projects with a total of over £380 million. This is due to the 22-year contract worth £366 million that Cranfield University's Defence College of Management and Technology won in 2006 from the Ministry of Defence in order to educate its service and civilian personnel. A project of such enormous scale inevitably skews the totals produced by our data. In fact it makes up over half of the total amount of money known to have been received by all 26 universities. However, as discussed in Section 3.2, there are several other factors which make calculating a total value for individual universities' military projects an inexact science and the amounts received should be treated as estimated minimums.

Project size and scale

In terms of duration and cost, nearly half of all projects were small-scale, with a contract value of under £100,000. Generally speaking, projects with a low contract value are for a short time period e.g. 12 months, with project duration increasing in relation to project value. 16% of projects had a medium-high project value of £200,000–£499,000. Significantly, 114 projects (6%) were worth £500,000 or more. Our research indicates that there is a spread of funding, so that universities compete for a variety of short-term, low-

Table 3.3 Value of military projects at UK universities 2001–2006⁶⁶

Amount	Total
0–£49,999	731
£50,000–£99,999	187
£100,000–£199,999	290
£200,000–£499,999	298
£500,000	114

cost contracts and a smaller number of longer-term, more lucrative contracts.⁶⁷ Furthermore, there is evidence that the smaller scale projects will often be supporting the very large projects which are typically collaborations involving several organisations. This arrangement goes some way to explaining the tendency towards the centralisation of military research so that a few elite universities win the larger contracts and other 'satellite' universities play a supporting role.⁶⁸

Which university departments conduct military projects?

The projects can be further categorised by university department⁶⁹ as follows:

It is clear from Table 3.4, that the military projects we discovered are primarily conducted within the Science, Engineering and Technology departments of universities and that Engineering departments have by far the greatest proportion of these projects. The importance of these disciplines to the military sector, is highlighted by the MoD's 2006 Defence Technology Strategy – "the UK has a world-class science and engineering academic infrastructure; remaining second only to the US in global scientific excellence."⁷⁰ The expertise residing in UK universities is important to the military, as it presents advanced and innovative technology as being essential for national security:

"Today the UK faces adversaries whose tactics change rapidly and employ ever more varied advanced and innovative technologies. This demands rapid evolution in our response, both tactically and in the technologies we deploy to combat the threats. We must therefore continuously examine the balance and quantity of our

Table 3.4 – university departments conducting military projects

Department	No. of projects	% of total
Engineering (Electrical, Electronic, Mechanical, Civil, Aerospace, Marine, Chemical)	1,042	55.0
Computer/ Information Sciences	143	7.5
Mathematics/ Physics/ Astronomy	128	6.8
Materials/ Metallurgy	112	5.9
Human Sciences	72	3.8
Chemistry/ Biochemistry	48	2.5
Management/ Economics/Business	36	1.9
Manufacturing/ Industrial/ Applied Research	35	1.9
Earth Sciences	33	1.7
Defence	18	1.0
Social Sciences	15	1.0
Miscellaneous/ Unattributed	216	11.3

research and development (R&D) investment to meet these changing circumstances."⁷¹

The development of such high technology military equipment and weaponry is critically dependent upon workers in science, engineering and technology, leading to the MoD's budget for research and development ballooning to over £2 billion a year – 30% of the total government funds for UK R&D (See Table 2.1).

Table 3.5 – top 10 organisations funding military projects at UK universities

Organisation	Type of organisation ⁷²	Number of projects	% of total
Engineering and Physical Sciences Research Council (EPSRC)	Public non-military	549	29.0
Rolls Royce	Private military	495	26.0
BAE Systems	Private military	439	23.0
QinetiQ	Private military	394	21.0
Defence Science Technology Laboratories (Dstl)	Public military	190	10.0
Ministry of Defence (MoD)	Public military	182	9.5
Defence Evaluation Research Agency (DERA) ⁷³	Public military	84	4.0
GKN/ Agusta Westland	Private military	72	3.8
Thales	Private military	68	3.6
Atomic Weapons Establishment Plc (AWE) ⁷⁴	Public military	46	2.0

Who funds military projects?

Table 3.5 lists the top ten organisations which were sponsors and/ or partners of military projects at the 26 UK universities covered by this report between 2001 and 2006.

As the table shows, a small group of three powerful multinational companies, Rolls Royce, BAE Systems and QinetiQ, were involved as the sponsors/ partners of over two-thirds of all military projects at the 26 UK universities. In terms of military revenue, they are all in the top forty companies in the world, their individual rankings for 2006 being: BAE Systems (3rd), Rolls Royce (16th) and QinetiQ (36th).⁷⁵ These companies' cumulative power (which is predominantly BAE Systems', given the support it gets from the UK government) in global markets explains why the UK was, in 2006, the third largest arms exporter in the world.⁷⁶

It is significant that the EPSRC was involved in funding nearly a third of all the military projects we found. For the EPSRC's own data (as described in Section 2) shows that the council collaborates closely with military industry – spending an average of £35 million every year on academic projects in the military sector⁷⁷ and often works with “the large multinational companies, BAE Systems and Rolls-Royce, with

the newly privatised QinetiQ in third place.”⁷⁸ Because our evidence regarding the role the EPSRC plays in supporting military research at the 26 UK universities we studied has several similarities to the EPSRC's own data, it is reasonable to suggest that it is an accurate representation of the dominant trends in the military funding of UK universities. Furthermore, many of the projects undertaken by the UK government's military research establishment,⁷⁹ which was involved in a quarter of all military projects at the 26 UK universities, will also have benefited from the financial support of the EPSRC, through the Joint Grants Scheme (see Section 2.1).

Whether the military sector and, in particular, military industry, will continue to benefit from the EPSRC's collaborative funding of university research, is crucial to the future strength of the university-military relationship. According to a June 2007 Flight International article,⁸⁰ new financing rules for UK universities, introduced in October 2006, stipulate that industry will have to begin paying the full economic cost of contracts. This led to a predictably hostile reaction from companies such as Rolls Royce, who find such demands economically unacceptable. This is primarily because, under these rules, military industry's costs will increase, thus greatly diminishing the attraction to them of

Table 3.6 – key statistics: University of Bristol

University of Bristol's Military Projects 2001–2006

Total no. of projects	Minimum amount received from projects	Rank (out of 26, by no. of projects)	Top 3 departments (by no. of projects) ⁸¹	Top 3 funders (by no. of projects)
101	£12,109,941	6th	1) Aerospace Engineering 2) Mechanical Engineering 3) Electrical and Electronic Engineering	1) QinetiQ 2) EPSRC 3) Dstl

Table 3.7 – military project: University of Bristol

Department: Aerospace Engineering

Source/ Sponsor/ Partner	Project	Amount	Date
EPSRC, BAE Systems Operations Ltd, QinetiQ Ltd	Unsteady Aerodynamics Simulation by Flight Control System Integration with Structure-Coupled CFD	£148,562	Oct 2002 – May 2006 ⁸²

working with UK universities. The importance of UK universities having an ‘attractive business environment’ is so great that Rolls Royce are threatening to turn to foreign universities' research laboratories if their demands are not met. As well as such threats, The Society of British Aerospace Companies – a body which represents many of the major producers of military equipment – has begun lobbying government to provide compensation in the form of extra funds from the UK's research councils, a move which, if successful, would inevitably mean an increase in the EPSRC's support of military research.

Section 3.2: Case study: the University of Bristol

What the data means

This section aims to analyse and discuss the data we have collected for the 26 universities covered in our report by focusing on one university's data. The University of Bristol has been chosen as our case study, as its data is illustrative of several of the important issues and problems we have encountered during the research phase of this report.

To view all of the military projects we found at the University of Bristol between 2001 and 2006, please visit our website: www.studywarnomore.org.uk

Total number of projects

Between 2001 and 2006, we found 101 military projects conducted by the University of Bristol. Most of this data – 82 projects – was received in response to Freedom of Information requests from the university itself, as Bristol returned one of the largest sets of data out of the universities covered by this report. Other sources used were the Engineering and Physical Sciences Research Council (EPSRC) website which yielded 17 projects and the University of Bristol website with 4 projects. The vast majority of these projects are for research, conducted in a departmental laboratory by a researcher and/ or a research team which has received funding from one or more military organisations. The project shown in Table 3.7 is an example which comfortably fits in to the parameters we have set for our report.

This project has industrial partners with large military revenues, a research focus within an engineering department, a monetary value, was within our timeframe and is referenced on the EPSRC website. Therefore, because there is a high

probability that the research conducted for this project will have a military application and all the necessary data is present, this project fulfils all our report's requirements. It must be noted however, that, in terms of data provision, this project is not representative of all the projects we discovered at Bristol (or indeed the other 25 universities), many of which were missing elements of data. This did not disqualify them from inclusion, if there was data proving a strong probability of the project having a military application, and if the project took place within our timeframe.

Source/ Sponsor/ Partner-defining projects as military

In order to define projects as 'military', we had to decide which organisations we would designate as 'military organisations.' With regards to Bristol University, Rolls Royce, GKN Westland (now part of Finmeccanica of Italy), Smiths Group (the relevant work is now likely to be within General Electric of the US), BAE Systems, Boeing, Cobham, EADS, Finmeccanica, Thales, VT Group and QinetiQ all sponsored projects, of varying numbers and values, between 2001 and 2006. These companies have been designated as military organisations, as they were all in the top 60 companies in terms of military revenue for 2005.⁸³ As such, whilst they all have varying degrees of civil production, they also produce very significant amounts of military material – with companies such as BAE Systems, QinetiQ and VT Group receiving over three quarters of their revenue from military sales.

Table 3.8 – military project: University of Bristol

Department: Aerospace Engineering			
Source/ Sponsor/ Partner	Project	Amount	Date
Department of Trade and Industry LINK	PUMA DARP: Unsteady Aerodynamics Prediction and Simulation for Airframe and Turbomachinery Applications	£242,187	Apr 2003 onwards ⁸⁴

Table 3.9 –military project: University of Bristol

Department: Mechanical Engineering			
Source/ Sponsor/ Partner	Project	Amount	Date
Ministry of Defence	Multiscale Approaches to Enhance Materials Performance	£487,674	Oct 2005 onwards ⁸⁵

In a few instances, project sponsors were not themselves military organisations, yet because we could make a strong link to military applications for the project, the project was included. The 'PUMA DARP' project at Bristol shown in Table 3.8 gives an example of this.

Whilst the Department of Trade and Industry (DTI) is a non-military governmental body, the project concerns the 'PUMA DARP,' which – as discussed in Section 3.3 – is an industry-led university partnership (DARP stands for Defence and Aerospace Research Partnership), involving BAE Systems, Rolls Royce and QinetiQ as industrial members as well as several academic partners.

Other projects, such as those shown in Table 3.9 and Table 3.10, are more obviously military, in that they were sponsored by the Ministry of Defence. The first example is of note for its high level of funding: nearly £0.5 million. Furthermore, both have an indeterminate timescale, so that we do not know whether the dates given refer to when the money for the projects was received or to each project's start date.

What kinds of military projects are there?

As will be shown in Section 3.3, Bristol University is a partner in a variety of large-scale, multi-million pound, collaborative projects involving different public and private sponsors. Bristol is also involved in numerous small and medium scale projects, both in terms of duration and value. Many of these

Table 3.10 – military project: University of Bristol

Department: Interface Analysis Centre			
Source/ Sponsor/ Partner	Project	Amount	Date
Ministry of Defence	Environmental Remediation of Heavy Metals and Radionuclides	£171,659	Feb 2006 onwards ⁸⁶

Table 3.11 – military project: University of Bristol

Department: Electrical and Electronic Engineering			
Source/ Sponsor/ Partner	Project	Amount	Date
QinetiQ Ltd	A Single Photon Source Characterisation Facility and Novel Single Photon Sources	£75,950	Oct 2003 ⁸⁷

projects carry titles which are impenetrable to the uninitiated. For example, note the title of the project shown in Table 3.11.

A photon is "the quantum, or bundle of energy, in which light and other forms of electromagnetic radiation are emitted,"⁸⁸ so this project presumably concerns how Bristol University can create a research facility/ equipment capable of identifying and describing new and existing photon sources. The Optics/ Photonics Group of Bristol's Electrical and Electronic Engineering department website describes, in general terms, why such research is conducted:

"The increased demand for data and telecommunications services is currently causing a major expansion in the range of applications of optical communications systems... Bristol started a new activity in Quantum Optical Communications and Computation in 2003. This is developing secure communications based on single photon level encoding and logic devices for future Quantum Computers...Other novel areas are projects investigating short wavelength (blue) GaN lasers for data storage and VCSEL based wireless-over-fibre systems."⁸⁹

Given that the project above also started in 2003 within this department, and involves the study of 'single photons,' it is reasonable to deduce that it will have applications in the fields mentioned above i.e. data and telecommunications and then specific technologies such as 'Quantum Computers' and 'lasers for data storage.' The next question we must ask is –

What does this have to do with military research and QinetiQ⁹⁰ – the project's sponsor? QinetiQ's Communication Division is a key part of its business in supplying 'technology solutions' to military organisations such as the MoD and specialises in "the delivery of innovative fixed and mobile communications."⁹¹ The MoD's Defence Technology Strategy describes communications as one of the UK's "technical strengths with widespread battle winning applications," and later describes why this is the case:

"Many defence communications systems have to be deployed rapidly, have to work in difficult environments and must provide a high level of information assurance, both short and long term. The military networks to support tactical forces are particularly challenging requirements since they must be mobile, robust to attack and resilient to failure."⁹²

Despite this evidence linking the above project to military organisations and their technological needs, we cannot know with complete certainty that the project described above will have military applications. Furthermore, this report is not able (for reasons which should be evident) to analyse each of the many hundreds of projects discovered through our research. However, to deny that there is less than a strong probability that such projects will have military usages, is to refute the premise that organisations with high military spending or revenue will seek to sponsor research that relates to their core military needs and production.

Table 3.12 – military project: University of Bristol

Department: Division of Farm Animal Science

Source/ Sponsor/ Partner	Project	Amount	Date
Defence Science Technology Laboratory	Research into the Tracking and Trailing of Dogs	£35,110	Oct 2003 onwards ⁹³

Table 3.13 – military project: University of Bristol

Department: Clinical Science at South Bristol

Source/ Sponsor/ Partner	Project	Amount	Date
QinetiQ Ltd	Studies of the Behavioural Effects of Fear – Performance Measures	£35,392	Sept 2001 onwards ⁹⁴

Table 3.14 – military project: University of Bristol

Department: Community Based Medicine

Source/ Sponsor/ Partner	Project	Amount	Date
Defence Science Technology Laboratory	Analysis of Sleep Recordings	£15,000	Jul 2003 ⁹⁵

Table 3.15 – military project: University of Bristol

Department: Mathematics

Source/ Sponsor/ Partner	Project	Amount	Date
EPSRC, BAE Systems (Strategic Partnership) Involves: • Imperial College London • University of Southampton • University of Bristol • Oxford University	Autonomous Learning Agents for Decentralised Data and Information Networks (ALADDIN). (Note. It is known that under this scheme the University of Southampton received £5,469,161 for Decentralised Data and Information Systems research.) ⁹⁶	£?	2005–2010 ⁹⁷

Projects outside Engineering departments

As highlighted previously, the majority of military projects are conducted within the Engineering departments of UK universities. Similarly, the departments conducting the most projects at Bristol were, in order of magnitude: 1) Aerospace Engineering, 2) Mechanical Engineering and 3) Electrical and Electronic Engineering. However, military organisations also sponsor research in a variety of other science departments, which is related to applications other than weapons technology. Bristol is no exception, as the selections from individual departments in Tables 3.12 to 3.14 illustrate. (NB In total, between 2003 and 2005, Bristol's Division of Farm Animal Science received £312,252 from the Defence Science Technology Laboratory (Dstl) for projects related to the training and handling of dogs.)

The fact that military organisations are seeking to fund projects in universities concerning the psychological and physical needs of their personnel and animals, indicates that the military looks to universities to carry out a wide range of its research needs.

Amount received from projects

The minimum amount received by Bristol University for military projects between 2001 and 2006 is £12,109,941. This figure is termed 'minimum' for several reasons, including the finite scope of our research, the inaccessible nature of some data (e.g. for reasons of commercial confidentiality) and the incomplete project data from some of our sources. The project shown in Table 3.15 gives an example of the size of projects which we have not been able to add to the monetary total for Bristol and other universities due to lack of information.

ALADDIN is clearly a flagship, inter-disciplinary, collaborative project, funded by the EPSRC and BAE Systems as part of their £30 million Strategic Partnership.⁹⁸ Yet, despite the project being part-sponsored by the EPSRC – a publicly funded research council – we could only find data for one of the four universities listed as partners in the project on the EPSRC website. Furthermore, the entry for Southampton University was not clearly listed as being part of the ALADDIN project, but goes under the name of "Decentralised Data and Information Systems."

This lack of clarity – whether intentional or not – was encountered throughout the researching of this report. The consequence of such partial information is that we cannot give a value for Bristol's involvement in the project, despite the fact that, given Southampton's large grant of over £5 million, Bristol must also have received a grant of significant value. This indicates that the real total value of military

projects is far in excess of that estimated. Moreover, this example shows how the quality and quantity of data available for a university determine, to some extent, how many (both in terms of number and value of projects) military projects we have been able to present with a full complement of data. The rankings given to each university must be viewed with this qualification in mind.

Miscellaneous projects

As well as projects with full data, which are attributable to specific departments, projects for some universities contained information which was partial and yet could still be defined as military. Most numerous were projects which we have counted as being 'miscellaneous,' for they are not attributable to a department. Bristol has 37 miscellaneous projects – a high number compared to other universities – all of which were listed by the university in responses to Freedom of Information Act requests.

The four projects listed in Table 3.16 give a further indication of how problematic it is to arrive at an accurate total for the amount of money a university has received over a five year period for military projects. Firstly, because the department and project title were not given, and secondly, because the date of the entry overlaps with dates of projects we have found from other sources. To take one example, the entry for the 'Defence Science Technology Laboratory' for '2003–2004,' which was for '£138,142' could contain within it the project in the department of Community Based Medicine in Table 3.14.

Furthermore, there is often a discrepancy between the total given by the university for money received over a financial year from a military organisation and the total we have calculated from our various sources. In this case for 2003–2004 we found projects totaling £71,949 funded by Dstl where the university had given £138,142, and for 2004–2005 we found projects funded by Dstl totaling £280,558 where the university had given £127,915. This problem is caused because a project's start date (i.e. month/ year) may not correspond with when a university received funding for it and recorded it as income.

Table 3.16 – military project: University of Bristol

Department: Miscellaneous			
Source/ Sponsor/ Partner	Project	Amount	Date
Defence Science Technology Laboratory	?	0	Financial Year 2000 to 2002 ⁹⁹
Defence Science Technology Laboratory	?	£9,320	FY 2002/ 2003 ¹⁰⁰
Defence Science Technology Laboratory	?	£138,142	FY 2003 to 2004 ¹⁰¹
Defence Science Technology Laboratory	?	£127,915	FY 2004 to 2005 ¹⁰²

Section 3.3: Examples of university-military programmes and projects

Introduction

Over 70% of the military projects discovered by our report are for military research,¹⁰³ and several of these are multi-million pound, long-term collaborative projects involving one or more military sponsors and/ or UK universities. University departments are given incentives by the government to join industry in forming commercial ‘partnerships’ so that the high costs and risks inherent in the development of novel and innovative technology aren’t sustained by industry alone. Instead, the taxpayer will be expected to foot the bill so that UK military industry can stay ‘competitive’ across global arms markets. Such support is vital, according to one arms company chairman, as “the industry is facing relentless pressure from countries who are aggressively promoting their own aerospace industries.”¹⁰⁴ Industry-led university partnerships presented below – such as the Defence Technology Centres, Towers of Excellence and Defence Aerospace Research Partnerships, which all receive generous public funding, are thus warmly embraced by the military sector.

Moreover, the choice of which universities to ‘partner,’ is of fundamental importance to the character of the university-military complex. BAE Systems describes its policy in the following way: “The FLAVIIR project forms part of the BAE Systems strategy to concentrate its funding on a few selected universities, to increase company involvement in these university programmes.”¹⁰⁵ For the FLAVIIR project, there are ten universities, with Cranfield and Imperial College, London

allocated a managerial role. The role of the other eight universities is akin to that of satellites, supporting the lead universities by focusing on the particular technologies they excel in. Those university departments most willing to adopt the commercial agenda of corporations are thus tied ever closer to their military paymasters.

Defence Technology Centres (DTCs)

Defence Technology Centres were introduced by the Ministry of Defence in February 2002 so that military industry and universities can collaborate closely in developing new military technology. DTCs are referred to in the Defence Technology Strategy of 2006 as being “clear evidence of the benefits of using a partnering approach to develop critical technologies for key topics in defence.”¹⁰⁶ This partnering approach entails the MoD fostering collaborations with industry and universities, to produce “innovative, cutting edge research for enhanced UK Defence capability.”¹⁰⁷

The DTCs are jointly funded by the MoD and industry – with the MoD earmarking “£90 million to the DTCs over a 5 year period.”¹⁰⁸ As with FLAVIIR, the DTCs have seen the institution of “a flexible management approach that allows an effective response to different situations and emerging needs and priorities.”¹⁰⁹ There are currently four Defence Technology Centres, involving the following academic and industry members:¹¹⁰

Towers of Excellence (ToEs)

Also launched in 2002, the Towers of Excellence comprise researchers from government, universities and military industry. The ToE’s goal is to develop innovative technology for the Ministry of Defence, particularly in areas where industry can capitalise commercially by developing ‘world-

Table 3.17 – Defence Technology Centres: Who was involved in 2004

Defence Technology Centre	Academic members	Industry members
Data Information Fusion (DIF-DTC)	Bristol, Cambridge, Cardiff, Cranfield, De Montfort, Imperial College, London, Southampton and Surrey	General Dynamics UK, BTexact, QinetiQ
Human Factors Integration (HFI-DTC)	Birmingham, Brunel, Cranfield	Aerosystems International, Lockheed Martin UK Integrated Systems, MBDA, Systems Engineering and Assessment and VP Defence
Systems Engineering for Autonomous Systems (SEAS-DTC) ¹¹¹	Bath, Bristol, Heriot-Watt, Imperial College, London, Liverpool, Loughborough, St Andrews, University College, London, University of the West of England, York	BAE Systems, ¹¹² MBDA Missile Systems, Roke Manor Research, SELEX Sensors, ¹¹³ Rolls Royce, and Airborne Systems, JACK Intelligent Agents, CAE, Smiths, QinetiQ
Electromagnetic Remote Sensing (EMRS-DTC) ¹¹⁴	Birmingham, Edinburgh, Glasgow, Heriot-Watt, Imperial College, London, Leeds, Cranfield, St Andrews, Sheffield, Strathclyde and Southampton	SELEX Sensors & Airborne Systems, Thales Defence, Roke Manor Research, and Filtronic

beating’ products. Current participants include BAE Systems, Alenia Marconi, Thales, Dstl, QinetiQ, MoD, DTI and DPA. There are six priority research areas: guided weapons, electro-optic sensors, synthetic environments, radar, underwater sensors, electronic warfare. In 2004 there were a total of four ToEs with the following academic partners:

NB Student training and research opportunities are offered by both the DTCs and ToEs

Table 3.18 – Towers of Excellence: Who was involved in 2004

Tower	Academic partners
Guided weapons	Cranfield, Imperial College, London
Radar	Cranfield, Birmingham, Sheffield, Surrey, Imperial College, London
Underwater Sensors	Heriot-Watt, Imperial College, London, Southampton, Loughborough, Bath, University College, London
Synthetic Environments	Cranfield

Defence and Aerospace Research Partnerships (DARPS)

DARPs are industry-led university-based partnerships, involving research which will benefit military objectives, including the design of advanced weapons and launch platforms. DARPS are funded by the Engineering and Physical Sciences Research Council (EPSRC), DTI Aeronautics Research Programme, Ministry of Defence and industry. The overall value of the research programme is some £18 million,¹¹⁵ of which the total EPSRC involvement is £7 million.¹¹⁶

DARPS are managed by the Research and Technology Task Force, whose chairman is an employee of Rolls Royce. This is a sub-group of the National Defence and Aerospace Systems Panel (NDASP), an MoD/ DTI sponsored panel whose members come from government, industry, academia, and trade associations.¹¹⁷ The DARPs were announced in 2002–03 and the research commissioned formally started after 1st April 2003. It is interesting to note the repeated involvement in the DARPS of BAE Systems, Rolls Royce and QinetiQ, which were each involved in six out of the eight DARPS listed. As stated above, our evidence found this trio to be the sponsors/ partners of over two-thirds of all military projects at the 26 UK universities. There are twelve DARPS in total, although information regarding academic and industry members was only available for the following seven, because no up-to-date information could be found on public websites:

Table 3.19 – Defence and Aerospace Research Partnerships: Who was involved in 2004

Partnership	Academic members	Industry members
Rotorcraft	City University, Glasgow, Bristol, Southampton, Imperial College, London, Leicester, Glasgow Caledonian	GKN/ Westland Helicopters
Advanced Metallic Airframes	Oxford, Southampton, Imperial College, London	BAE Systems/ Airbus/ Filton, Westland Helicopters, QinetiQ
High Integrity Real Time (HIRTS)	York, Newcastle	Rolls Royce, BAE Systems, QinetiQ
Modelling & Simulation of Turbulence & Transition for Aerospace	Cranfield, Manchester, Imperial College, London, Loughborough, Southampton, Cambridge	BAE Systems, QinetiQ, Rolls Royce
Advanced Aeroengine Materials (ADAM)	Birmingham, Swansea, Cranfield, Cambridge, Oxford	Rolls Royce, QinetiQ
A Partnership for Research in Data & Sensor Fusion	Manchester, Oxford, Southampton, Swansea	BAE Systems, QinetiQ, Rolls Royce
Unsteady Modelling for Aerodynamics (PUMA), DARP for Design	Manchester, Bristol, Glasgow, Surrey, Sussex, Cambridge	BAE Systems, QinetiQ, Airbus, Rolls Royce

FLAVIIR (Flapless Aerial Vehicle Integrated Interdisciplinary Research Programme)

Managed from Cranfield University, FLAVIIR is a £6.2 million, public-private funded project,¹¹⁸ running between 2004 and 2009, involving ten universities, predominantly in their Engineering departments. According to its website, FLAVIIR will “look at technologies for future unmanned air vehicles (UAV) funded jointly by BAE Systems and EPSRC.”¹¹⁹ FLAVIIR forms part of BAE Systems’ strategy to “concentrate its funding on a few selected universities, to increase company involvement in these university programmes, to facilitate a greater degree of cooperation between university partners and to include system integration into the research agenda.”¹²⁰

Under FLAVIIR, each of the ten participating universities has been assigned one (or more) of the seven themed technical research areas, to be investigated over an initial 3-year period. The research will then be brought together for a two-year ‘demonstration phase.’ In order for BAE Systems to retain effective control over FLAVIIR, “day to day running of the project is undertaken by the Project Director (a Cranfield Professor) and a Project Manager (from BAE Systems). This level of management allows flexibility for BAE Systems to change the project direction as company needs dictate.”¹²¹

International Technology Alliance in Network and Information Sciences

The International Technology Alliance (ITA) was launched in 2006, as the Ministry of Defence and US Department of Defense chose an IBM-led consortium to undertake a new joint government/ industry advanced technology partnership exploring secure wireless and sensor networks. According to Dr Thomas H. Killion, U.S. Army Chief Scientist, the ITA will allow “the best in our industry and university communities on both sides of the Atlantic” to focus “on the scientific enablers of net-centric warfare.”¹²²

Funding of up to \$135.8 million for the ITA comes from the MoD, Department of Defense and some of the consortium members, with separately funded “technology transition awards, to allow each client to rapidly exploit the research results.”¹²³ Imperial College London’s Professor Sir Roy Anderson (also the MoD’s Chief Scientific Adviser) says the ITA has taken “the best features of the MoD’s Defence Technology Centres and the US Army’s Collaborative Technology Alliances, and applied them internationally.”

The ITA’s research programme involves four interconnected areas of research over a potential 10 year period: network theory; security across a system of systems; sensor information processing and delivery; and distributed coalition planning

and decision making. This research is intended to facilitate effective communications in “successful future military operations,” enabling “coalition forces to quickly gather, interpret and share battlefield information.”¹²⁴

With 25 partners, the consortium is one of the world’s largest collaborative technology programmes and comprises the following organisations:

US Industry: IBM; BBN Technologies; The Boeing Company; Honeywell; Applied Research Associates.

UK Industry: IBM; LogicaCMG; Roke Manor Research; Systems Engineering and Assessment.

US Academia: Carnegie Mellon University; City University of New York; Columbia University; University of Maryland; University of Massachusetts, Amherst; Pennsylvania State University; Rensselaer Polytechnic Institute; University of California, Los Angeles.

UK Academia: Imperial College, London; University of Aberdeen; University of Cambridge; University of Cranfield; Royal Holloway and Bedford New College (University of London); University of Southampton; University of York.

Rolls Royce University Technology Centres (UTCs)

Rolls Royce at present supports over 20 University Technology Centres which are embedded in 15 universities throughout the UK, with some universities having more than one UTC. UTCs cover Rolls Royce’s major businesses (civil and military aerospace, marine and energy). A primary role of such Centres is both short-term and long-term research supporting the company’s business aims through “improving the product, improving productivity and reducing cost-of-ownership.”¹²⁵ The UTC website at Nottingham University gives an insight into the level of funding provided by Rolls Royce and the involvement of other organisations which benefit from the dissemination of UTC research:

“Initial research is concentrated on the needs of Rolls-Royce, which is investing £300,000 a year in the new venture, but it is hoped that the UTC will provide the catalyst for involvement by a broader spectrum of UK industry and an expansion of the Centre’s overall scope in manufacturing technology.”¹²⁶

Furthermore, UTCs such as the one at York, are described as ‘complementing’ other projects within the university. The fact that these are projects involving BAE Systems and/ or a Defence Aerospace Research Project (DARP), gives strong evidence that the UTC in question will have military applications. The following table shows the UTCs at UK universities as of 2004.

Table 3.20 – Rolls Royce University Technology Centres: Who was involved in 2004

University	Number of Rolls Royce UTC(s)
Birmingham	1
Cambridge	2
Cranfield	1
Imperial College London	1
Loughborough	1
Manchester	1
Nottingham	2
Oxford	2
Sheffield	4
Southampton	2
Strathclyde	1
Surrey	1
Sussex	1
Swansea	1
York	1

NB The University of Sheffield has four UTCs as of 2007.

Military-related projects

As well as the many military research projects we found at the 26 UK universities we investigated, we discovered over 300 military-related projects,¹²⁷ which accounted for 17% of the total. The first example is of a major MoD project contracted to Cranfield University, followed by several military-related projects at Leeds University.

Defence Education of Service and Civilian Personnel, Cranfield University

In 2006, Cranfield University’s Defence College of Management and Technology won a £366 million, 22-year contract from the Ministry of Defence to educate its service

and civilian personnel.¹²⁸ The contract which Cranfield held previously with the MoD (for 10 years from 1996) was of a similar order of magnitude. The MoD contract is to deliver postgraduate education and training to around 4,000 students per year, involving individuals at all levels from the Royal Navy, Army, Royal Air Force and the Civil Service.

Around 80 different courses on a range of topics are to be provided, including defence technology, information management, strategic leadership, acquisition management and security studies. Cranfield will work with the Open University as its principal sub-contractor. King's College,

London; academic provider to the Joint Services Command and Staff College at Shrivenham, will also be supplying courses in defence studies as part of the contract.

Military-Related projects at Leeds University¹²⁹

The projects at Leeds University listed below give an indication of the type of non-research projects the military sector funds at UK universities. The projects are small-scale and involve relatively small amounts of money, but show how military corporations seek to use UK universities for a variety of their business needs – whether training for current staff or

Table 3.21 – Military-Related project: Leeds University			
Department: Careers			
Source/ Sponsor/ Partner	Project	Amount	Year
BAE	Yorkshire Graduate Recruitment Fair	£492	June 2002 ¹³⁰

Table 3.22 – Military-Related project: Leeds University			
Department: School of Process Environmental and Materials Engineering			
Source/ Sponsor/ Partner	Project	Amount	Year
Rolls Royce	Course – Combined Heat and Power in Industry and Commerce	£475	Mar 2001 ¹³¹

Table 3.23 – Military-Related project: Leeds University			
Department: Keyworth Institute			
Source/ Sponsor/ Partner	Project	Amount	Year
Thales Group	International Corporate Leadership Programme	£1,880	Sept 2002 ¹³²

Table 3.24 – Military-Related project: Leeds University			
Department: Institute for Medieval Studies			
Source/ Sponsor/ Partner	Project	Amount	Year
QinetiQ	Conference IMC 2001	£198	Apr 2001 ¹³³

graduate recruitment for future staff members. By becoming regular customers of university services (as well as research facilities) military companies confirm their status as an acceptable and necessary source of revenue. Such a relationship will, by its very nature, gradually change the way in which universities operate, as they seek to secure this funding source for the future by factoring in business needs to their overall strategy, leading them into an ever closer economic and cultural relationship with the military sector.

Section 3.4 Academics' perspectives

In order to gain an understanding of how scientists view military research and military-related projects being conducted in universities, questionnaires were sent out to academics from each of the 26 institutions covered by this report. Forty responses were received in all, including replies from professors, researchers and heads of department, mostly from faculties of science and engineering. This section provides a snapshot of opinion, rather than being a definitive guide to the actions and principles of academics. The responses received are valuable and pertinent to the report because they provide details of individual experience as well insights into the views of the academic community.

The following questions were posed:

- 1) i) Have you ever worked on research at any UK university which was either funded by a military/ defence organisation or which you knew to have military/ defence applications?

ii) If so, could you state which university(-ies), what the work involved and how it was funded?
- 2) Would you ever/ have you ever conducted classified military/ defence research?
- 3) i) Have you ever had any ethical training regarding your academic/ research work?

ii) If you have worked on military/ defence projects did you ever discuss the ethics/ end-use of your work with colleagues? If so, what kinds of issues/ ideas were raised?
- 4) How do you feel about university departments being used as research centres for military/ defence organisations?
- 5) Would/ have you ever turned down work because of moral issues/ personal beliefs/ concern over future applications e.g. because it was funded by military/ defence interests and/ or had military/ defence applications?

- 6) Do you think that the decision-making process regarding the funding of university research is democratic/ transparent and that the research conducted is publicly accountable? How important do you think these questions are?

NB Respondents have not been identified for reasons of confidentiality.

“These are issues of personal conscience as far as I’m concerned”

Broadly speaking, the replies received present a liberal view of the university-military relationship. For example, when it comes to the ethics of military research, many of the interviewees emphasise the ‘personal conscience’ of the individual scientist. Furthermore, decisions as to the morality of military research “depend upon the context and aims” so that “one has to consider individually each case.” Acceptable military work could therefore include “research on a vaccine against anthrax,” which “may be funded by the military, but have wholly laudable outcomes.”

A feeling of opposition to the regulation of research by committees (e.g. ethics) could be detected. These are deemed unnecessary because “the moral and ethical guardians of these projects are often the scientists themselves,” and “the problem with trying to introduce accountability is that the process may be corrupted by self-appointed, uninformed pressure groups.” One professor went further, stating that establishing “fully open systems” is “very difficult... and often undesirable.” This is because they are:

“‘Open’ to ill-informed comment and opinion from the many people who do not, or indeed intellectually cannot, understand the issues. A lot of issues around nuclear power/ warfare are in this category; the general public on the whole does not understand the science, nor the risk analysis, nor the impact on society of taking key decisions.”

Responding to whether the funding and conduct of university research was democratic and transparent, one head of department presented a more radical viewpoint:

“Not at all transparent or democratic. But I don’t think the university element of this is what is crucial, no part of our military research or industrial base has any democratic or transparent element.”

Another researcher described how the “expertism” of academe can render “the concepts of public accountability or democratic decision-making rather problematic. I would be a rather poor researcher if I could not put so much spin around a project as to make it look the very opposite of what it really

is.” For this academic, the ability of researchers to play the system and bypass formalised procedures means that the only solution is to “make the results of publicly funded or supported research publicly accessible,” even though “it may well be that this rules out most kinds of military research – but not all.”

Many scientists are protective of their right to freely conduct whatever research they choose, in order to advance science and the public good as they see fit. However, a problem arises because they also see a widening of the decision-making process (e.g. via ethics committees) that may include external, public, voices interfering in complex subjects only they, as specialists, can understand. In this way, several academics expressed a desire for public funding on the one hand and freedom from public discussion of how this money is spent on the other. This position prevents the establishment of bodies which could counteract the powerful military and corporate sector which seeks to impose its own narrow agenda onto campus. Instead, these academics prefer the security of military money to what they see as external interference in decisions that their ‘personal consciences’ should make. The question of who has the power to decide what research is valued and conducted in our society is clearly an important, political one, and is discussed further below.

“Almost any research one does could have defence applications!”

One viewpoint expressed again and again by interviewees regarded the difficulty of determining the end-use of research. Several materials scientists in particular, pointed out how their discipline could be channelled for military requirements, whether or not they approved. One such scientist expressed his views in the following way:

“Virtually all materials science research has at least some potential implications for military usage. It’s therefore virtually impossible for anyone in the materials science field to take a principled stand against doing any work with a possible military application.”

Basic research conducted on behalf of large corporations such as Rolls Royce, which has civil as well as military production, could contribute to any aspect of their business. One senior researcher, who had conducted work for several military organisations, was quite defensive in response to accusations of the work being military-oriented. This academic denied that the research conducted for the MoD and Rolls Royce Marine was “in any way related to defense matters,” because the projects involved product evolution and “inter - organisational relationships.”

Choosing to define a project as non-military by focusing on the type of problem the research investigated is to divorce the

project from the system of production in which it is embedded. The researcher quoted above even went so far as to include the Ministry of Defence as part of the ‘aerospace industry,’ sweeping away all other evidence to the contrary, such as the MoD’s role as an offensive fighting force deploying military units across the world. In doing so, the statement takes the project’s focus to be the only relevant aspect of the organisation in question, simply because that’s what the organisation had, in this one instance, contracted the researcher to investigate. This approach glosses over important questions regarding the potential applications of research funded by organisations which either spend large sums procuring military materiel or receive large sums manufacturing it.

Furthermore, the argument that basic research is non-military because Rolls Royce engages in both civilian and military production, can as easily be used to argue that such research has no relevance to civilian applications. Is it not more likely that Rolls Royce, as a corporation which exists to increase its market share, its profits and thus its shareholder value, will spend money on research which has applications across its business? If so, given that Rolls Royce is the world’s 16th largest company by military revenue,¹³⁴ it is surely also common sense that research carried out for it has a strong likelihood of being used for military production.

“The feeding frenzy”

In the UK, university research receives public funding through the “dual support” system, comprising a block grant allocated through the Research Assessment Exercise (RAE),¹³⁵ and by competitive grants and studentships which the Research Councils allocates to individuals for specific projects. Several academics drew attention to how the current research climate makes accepting money from the military sector an attractive proposition. One professor of engineering had this to say regarding the RAE:

“The UK university RAE is all powerful and encourages all academics to go for any funding no matter where it comes from (the “feeding frenzy”). If you turn down research funding, then you are automatically weakening your department’s prospective RAE performance and letting down your colleagues. The RAE definitely undermines research ethics in this respect.”

The Professor then went on to describe how industry benefits from this arrangement:

“Companies should pay full costs, but this is at the discretion of the researcher: there is a tendency to pay much less in order to secure contracts and hence get

RAE recognition. The extent of taxpayers’ subsidy to military research is hugely underestimated.”

Another professor described Research Council funding in the following way:

“Given the increasing selectivity and limited funding of research councils, the military-related sources have been very important in maintaining and developing my research.”

Academics who are prepared to accept military funding, do so for pragmatic reasons, as one retired professor says:

“I’ve discussed ethical issues with colleagues who *have* taken military money. A common response, e.g. with Star Wars, was that it was a project that wasn’t going to come to anything militarily, so might as well put the money that was flowing to productive use.”

To summarise then, because universities are forced to compete against each other for public funding, and because this funding is based upon the quality of research produced by each department, academics must win research grants to secure their department’s future, as well as their own. As Alex Callincos, in ‘Universities in a Neoliberal World’ explains:

“The cost of failing to make it as a ‘research university’ is very high. Institutions that fail to gain a decent amount of research funding are likely to experience a further decline in their relative competitiveness. An initial trend or weakness becomes self-fulfilling – falling recruitment, absence of research income, staff demoralisation, and a future as a ‘teaching-only’ institution.”¹³⁶

In the case of university departments such as Engineering, which have many potential research uses for military organisations, the problem of securing public funding can – and often is – solved, to a degree, through conducting military projects. As previously discussed, military organisations – such as the Ministry of Defence and BAE Systems – have a wide array of research contracts to award to pliant universities, often in partnership with the Engineering and Physical Sciences Research Council. Moreover, these projects often confer prestige on the researcher and the institution as a whole. The attraction of accepting military money is therefore great for institutions struggling to ensure their place in the hierarchy of the UK’s world-class, research-intensive universities. This constant pressure to attract new revenue streams will, inevitably, undermine research ethics, as the funding system is driven by the logic of productivity and competition. To argue that the ethics of the military funding of universities is dictated by an academic’s ‘personal conscience,’ is therefore to ignore the way in which the higher education system is state-controlled.

Thus, rather than there being free choices in a free market for academics, the choice, especially in departments useful to military industry, is often narrow, so that by turning down military funding “you are automatically weakening your department’s prospective RAE performance and letting down your colleagues.” Academics will therefore continue to take money from the military sector as long as universities suffer from funding shortfalls,¹³⁷ funding is tied to government measurements of research quality and the military sector (through such mechanisms as the National Defence Aerospace and Systems Panel identified in Section 2) is able to influence national research priorities by lobbying the UK government for higher military spending.

Section 4: Conclusions

There are eight main conclusions concerning military projects at UK universities, which have arisen as a result of the research undertaken for this report. These can be summarised as follows:

1. The research collected for this report shows that between 2001 and 2006, over 1,900 military projects, worth an estimated minimum of £725 million, were conducted across the 26 UK universities we investigated. The evidence indicates that universities are competing for a variety of short-term, low-cost contracts and a smaller number of longer-term, more lucrative contracts from the military sector.
2. Our data shows that the majority (70%) of military projects conducted at the 26 UK universities, can be identified as involving research for the military sector, including the Ministry of Defence and/ or military companies. Military organisations also funded and paid for a variety of other non-research projects including student and staff sponsorship, industrial placements, conferences, benefactions, consultancies, careers and graduate fairs, travel grants and teaching programmes. The ease with which the military sector can access university departments, through purchasing research and services and providing sponsorship, is indicative of the general trend towards commercialisation in higher education.
3. Military projects are primarily conducted within the Science, Engineering and Technology departments of the 26 universities we investigated, with Engineering departments having by far the greatest proportion of these projects. These departments are utilized by the military sector because they contain the necessary high-quality infrastructure and expertise to produce innovative research for the military's high-tech weapons, support and surveillance requirements. Furthermore, by sub-contracting research to universities, which have world-class, publicly-funded staff and facilities, the military sector can keep overheads down and, in the case of military companies, profits up.
4. The military projects conducted at the 26 UK universities covered by our report, were principally funded by the Ministry of Defence and military industry. Importantly, the publicly-funded, non-military Engineering and Physical Sciences Research Council helped to fund hundreds of the projects at UK universities that these

military organisations benefited from. These groups often collaborate on military projects, so that private funding, e.g. for a research contract, is often matched by public funding, making the project financially viable. The UK government's military research establishment – including the Ministry of Defence (MoD), Defence Science Technology Laboratory (Dstl), Defence Evaluation Research Agency (DERA) and Atomic Weapons Establishment (AWE) – funded a quarter of all military projects we investigated. Projects involving military industry mainly included a small group of highly influential corporations, comprising Rolls Royce, BAE Systems and QinetiQ, which were the sponsors/ partners of 70% of the projects we discovered at the 26 universities.

5. The EPSRC, through its policy of providing collaborative research grants with the MoD and military industry to universities, funded nearly a third of all the military projects we discovered. EPSRC funding more than matches contributions from the military sector for collaborative research grants, making these military research contracts lucrative sources of income to university departments. The EPSRC's support for the MoD and, in particular, military companies, is indicative of current trends in the public funding of UK universities, which is increasingly driven by the logic of productivity and competition. Whilst state spending on science has increased, it is largely intended to support industry targets and wealth creation, thus narrowing the scientific research agenda at universities.
6. Whilst the military sector – in particular military industry – greatly benefits from the knowledge produced by the many projects they sponsor and collaborate in at UK universities, their economic contribution to universities is relatively low, in comparison both to universities' annual research income and to military industry's annual R&D expenditure. This is partly explained by the fact that the larger and more costly research projects conducted by military companies at UK universities are made financially viable because they are often part-financed by public subsidies from the MoD and/ or the EPSRC.
7. Academics are under increasing pressure to attract research funding to their department, which can lead to research ethics being compromised, given the lure of these lucrative military research contracts. Furthermore, the temptation to accept funding from military organisations is made

greater, because such research often confers prestige on the researcher and the institution as a whole.

8. At present, even with the existence of the Freedom of Information Act, accessing data regarding the funding of universities by the military sector (for example from university and research council websites) is difficult and only presents, at best, a partial picture of the actual economic relationships. One reason for this – aside from the fact that institutions are often not compelled to

provide such information – is the need for commercial confidentiality between competing organisations (including universities) and the cloak of secrecy surrounding the military sector. Without full transparency in the future, including clear and easily accessible information concerning how public money is used to support projects conducted by the military sector, it will not be possible to accurately assess the extent of military involvement in UK universities or monitor developments and trends.

Get involved

Visit our campaign website: www.studywarnomore.org.uk

Our new campaign website is the place to go if you want to help us raise awareness of military involvement at your university, get tips and advice on campaigning, get in touch with campaigners at other universities or want to find out in more detail how your university is funded by the military sector. The Study War No More website also contains all the data collected for this report regarding military funding at each of the 26 UK universities between 2001 and 2006. The website will also help you if your university is not covered by this report and you want to discover whether its departments

are funded by military organisations. An online guide will show you how to utilise the Freedom of Information Act and other tools to conduct efficient research and give you ideas about how to campaign for transparency, accountability and democracy. Please contact us by email: request@studywarnomore.org.uk or by phone: 01865 748 796. We can let you know about news and events in your area, the best way to get involved, and provide in-depth information about this report.

Abbreviations and acronyms

AWE	Atomic Weapons Establishment (Aldermaston, UK)
DARPS	Defence and Aerospace Research Partnerships (UK)
DERA	Defence Evaluation Research Agency (UK)
Dstl	Defence Science and Technology Laboratory (UK)
DTC	Defence Technology Centre (UK)
DTI	Department of Trade and Industry (now BERR – Department for Business, Enterprise and Regulatory Reform)
EPSRC	Engineering and Physical Sciences Research Council (UK)
FLAVIIR	Flapless Aerial Vehicle Integrated Interdisciplinary Research Programme
MoD	Ministry of Defence
R&D	Research and Development
ToE	Tower of Excellence (UK)
UTC	University Technology Centre (funded by Rolls Royce)

Endnotes

- 1 As explained in Section 1, the data here includes the 26 universities covered by our report and therefore does not include all UK universities.
- 2 Birmingham, Bristol, Cambridge, Cardiff, Edinburgh, Glasgow, Imperial College London, King's College London, Leeds, Liverpool, London School of Economics and Political Science, Manchester, Newcastle, Nottingham, Queen's University Belfast, Oxford, Sheffield, Southampton, University College London, Warwick.
- 3 "The Russell Group," <http://www.russellgroup.ac.uk/>
- 4 Cranfield, Durham, Hull, Loughborough, Swansea, York
- 5 Non-military organisations include, in the case of public bodies, those which do not have military remits for their budgets, and those which, in the case of private industry, do not have significant military revenues i.e. those not in the Top 100 companies in the world according to revenue from military sales.
- 6 2006 Defense News Top 100, <http://defensenews.com/index.php?S=07top100byname>
- 7 "Details of Grant", Engineering and Physical Science Research Council. <http://gow.epsrc.ac.uk/ViewGrant.aspx?GrantRef=GR/R89028/01>. January 2007.
- 8 Professor Keith Hartley, UK Defence R&D Policy, www.york.ac.uk/depts/econ/documents/research/dera.pdf
- 9 2006 Defense News Top 100, <http://defensenews.com/index.php?S=07top100byname>
- 10 With 25 partners, the International Technology Alliance is one of the world's largest collaborative technology programmes. See Section 3.3 for examples of university-military projects.
- 11 Ministry of Defence, 'Defence Spending,' <http://www.mod.uk/DefenceInternet/AboutDefence/Organisation/KeyFactsAboutDefence/DefenceSpending.html>
- 12 Department for Business Enterprise and Regulatory Reform, 'SBRI Participants Performance,' <http://www.dti.gov.uk/innovation/sbri/page39902.html>
- 13 Department for Business Enterprise and Regulatory Reform, 'SET Statistics – Science, engineering and technology indicators,' <http://www.dti.gov.uk/science/science-funding/set-stats/index.html>
- 14 Research Acquisition Organisation Yearbook, July 2006, p.13
- 15 Petter Stålenheim, Catalina Perdomo and Elisabeth Sköns, SIPRI Yearbook 2007, <http://yearbook2007.sipri.org/chap8/>
- 16 SIPRI Programme on Military Expenditure and Arms Production, 'The 15 major spender countries in 2006,' http://www.sipri.org/contents/milap/milex/mex_trends.html
- 17 Taken from the US Congressional Research Service report, 'Conventional Arms Transfers to Developing Nations 1999-2006', 26 September 2007

- 18 2006 Defense News Top 100, <http://defensenews.com/index.php?S=07top100>
- 19 Department for Business Enterprise and Regulatory Reform, *op. cit.*
- 20 *Ibid.*
- 21 Department for Business Enterprise and Regulatory Reform, 'SBRI Participants Performance,' <http://www.dti.gov.uk/innovation/sbri/page39902.html>
- 22 Research Acquisition Organisation Yearbook, *op. cit.*
- 23 Ministry of Defence, Defence White Paper, Defence Industrial Strategy, 2005, p.30
- 24 *Ibid.* p.32
- 25 Ministry of Defence, Defence Technology Strategy, 2006, p.8
- 26 2006 Defense News Top 100, <http://defensenews.com/index.php?S=07top100>
- 27 R. Lambert, Lambert Review of Business-University Collaboration, 2003, p.80. NB- The other main sources of university research funding in the UK in 2000-01 by ranking were; 1. Funding Councils (QR) 2. Research Councils 3. UK based charities 4. Government departments.
- 28 DTI, Ranking of the top 750 UK companies by R&D investment within industry sectors, 2005 R+D Scoreboard, p.91
- 29 Science Budget, Research Councils UK, <http://www.rcuk.ac.uk/aboutrcs/funding/scibudget>
- 30 Department for Business Enterprise and Regulatory Reform, *op. cit.*
- 31 Engineering and Physical Sciences Research Council (EPSRC), Annual Report 2004/05
- 32 *Ibid.*
- 33 Engineering and Physical Sciences Research Council (EPSRC), Aerospace and Defence Sector Report, 2004
- 34 *Ibid.*
- 35 From Hansard 18 March 2003, in Soldiers in the Laboratory, Scientists for Global Responsibility, p.42
- 36 Engineering and Physical Sciences Research Council (EPSRC), Annual Report 2004/05
- 37 Engineering and Physical Sciences Research Council (EPSRC), Aerospace and Defence Sector Report, 2004
- 38 *Ibid.*
- 39 *Ibid.*
- 40 *Ibid.*
- 41 Engineering and Physical Sciences Research Council (EPSRC), Strategic Plan 2003-2007, p.27
- 42 From Hansard 18 March 2003, in Soldiers in the Laboratory, Scientists for Global Responsibility, p.42
- 43 P. Cottrell, Association of University Teachers, <http://www.ucu.org.uk/circ/aut/html/la7120.html>
- 44 The Sutton Trust, 'Nobel Prizes- The Changing Pattern of Awards,' www.suttontrust.com/reports/nobel.doc, p.3
- 45 *Ibid.*

- 46 R. Lambert, Lambert Review of Business-University Collaboration, 2003, p.3
- 47 C.Langley, Scientists for Global Responsibility, Soldiers in the Laboratory, 2005, p.20
- 48 In 2007, the DTI became part of the Department for Business, Enterprise and Regulatory Reform.
- 49 C.Langley, Scientists for Global Responsibility, Soldiers in the Laboratory, 2005, p.19
- 50 Defence, Aerospace and Systems Panel, Future Activities 2001/2002, Research and Technology Task Force
- 51 *Ibid.*
- 52 Nick Hildyard, 'Scientific Research for Whom?', The Corner House, 1998, <http://www.thecornerhouse.org.uk/item.shtml?x=52185>
- 53 2006 Defense News Top 100, <http://defensenews.com/index.php?S=07top100byname>
- 54 As explained in Section 1, the data here includes the 26 universities covered by our report and therefore does not include all UK universities.
- 55 The total value of the projects does not relate to the total number of projects in this instance as not all projects included in the report had project values.
- 56 It is important to note that most of these multi-million military projects involved both several sponsors and more than one university and that, more often than not, we weren't able to tell from the data how much money had been received by each university.
- 57 "TATEM". University of Sheffield, Smart Structural Design, Research. <http://www.shef.ac.uk/structures/research/tatem.html>. 8 May 2007
- 58 FoI Letter 16 June 2006. And; "Current Sponsors". Advanced Manufacturing Research Centre, Sponsor Information. http://mmdesign.co.uk/amrc/about/sponsor_info.php. 9 May 2007
- 59 See Section 2 for a discussion of how much of military industry's R&D is subsidised by the UK government.
- 60 This often occurred where we only knew that a military organization had funded a project/given a grant to a university but did not know what the project was and if the project had other sponsors/partners.
- 61 The symbol '=' has been used where departments and funders have the same number of projects.
- 62 As described above and in Section 3.2, this figure is the minimum amount of funding received by universities for military projects which were ongoing between 2001 and 2006 as we were not able to identify the value of a number of projects. It should also be noted that 303 military projects we found to exist between 2001 and 2006 began before 2001, some as early as 1997 or before. It is likely therefore, that universities will have received funding to conduct many of these projects earlier than 2001.
- 63 Projects listed as 'Miscellaneous,' have not been included in this column. See Section 3.2 for a discussion of miscellaneous projects.
- 64 Much of the response (that which included full project details i.e. project title/department) Cambridge University gave to our FOI request, only concerned expenditure that was recorded by the University in a limited timeframe – between 1st August 2004 and

- 31st July 2005. This is important as it shows that there was a significant amount of information relevant to our report that we did not have access to, data which could have increased the data we were able to present.
- 65 Finances, University of Manchester, <http://www.manchester.ac.uk/aboutus/facts/statistics/finances/>
- 66 NB We could not find a value for 15% of the projects we discovered.
- 67 For examples of major university-military projects see Section 3.3.
- 68 See Section 3.3 for examples of this tendency.
- 69 Projects have been grouped by discipline according to the department in which they were conducted.
- 70 Ministry of Defence, Defence Technology Strategy, 2006, p.176
- 71 *Ibid.* p.6
- 72 For an explanation of the three types of organisation which fund military projects at UK universities see Section 1.
- 73 DERA was the UK government's defence research establishment until 2001, when it was split into the Defence Science and Technology Laboratory (public) and QinetiQ (part-private).
- 74 In 1993-4 management of the Atomic Weapons Establishment (AWE) became the responsibility of a private contractor, Hunting-BRAE. AWE is now a partnership with British Nuclear Fuels, Lockheed Martin and Serco.
- 75 2006 Defense News Top 100, <http://defensenews.com/index.php?S=07top100>
- 76 Taken from the US Congressional Research Service report, 'Conventional Arms Transfers to Developing Nations 1999-2006', 26 September 2007.
- 77 Engineering and Physical Sciences Research Council (EPSRC), Aerospace and Defence Sector Report, 2004
- 78 *Ibid.*
- 79 Including Ministry of Defence (MoD), Defence Science Technology Laboratory (Dstl), Defence Evaluation Research Agency (DERA) and Atomic Weapons Establishment (AWE).
- 80 Flight, 'UK firms warn on university research,' <http://www.flightglobal.com/articles/2007/06/05/214418/uk-firms-warn-on-university-research.html>, 5th June 2007.
- 81 NB not including Miscellaneous
- 82 "Details of Grant", Engineering and Physical Science Research Council. <http://gow.epsrc.ac.uk/ViewGrant.aspx?GrantRef=GR/R89028/01>.
- 83 2006 Defense News Top 100, <http://defensenews.com/index.php?S=07top100>
- 84 Letter from University of Bristol in response to an FoI Request, 11th May 2006.
- 85 Letter from University of Bristol in response to an FoI Request, 11th May 2006.
- 86 *Ibid.*
- 87 *Ibid.*
- 88 photon. (n.d.). The American Heritage New Dictionary of Cultural Literacy, Third Edition. Retrieved August 22, 2007, from Dictionary.com website: <http://dictionary.reference.com/browse/photon>
- 89 Optics/Photonics Group, Faculty of Engineering, <http://www.bristol.ac.uk/eeng/oph/>, Updated 15/02/06

- 90 It should be noted that Bristol is one of QinetiQ's partner universities:
http://www.qinetiq.com/home/aboutqq/our_business/partnering/uni_partnerships.html
- 91 QinetiQ, Communications, Capabilities,
http://www.qinetiq.com/home/defence/technology_solutions/capabilities/capabilities.QuickNavPar.0001.File.pdf
- 92 Ministry of Defence, Defence Technology Strategy, 2006, p.46
- 93 Letter from University of Bristol in response to a FoI Request, 11 May 2006.
- 94 *Ibid.*
- 95 *Ibid.*
- 96 Details of Grant, Engineering and Physical Sciences Research Council,
<http://gow.epsrc.ac.uk/ViewGrant.aspx?GrantRef=EP/C548051/1> and IAM News, Electronics and Computer Science, University of Southampton, <http://www.iam.ecs.soton.ac.uk/news/838>
- 97 Multi-disciplinary, multi-centre project involving Southampton, Imperial, Oxford, Bristol and BAE Systems PLC,
<http://www.aladdinproject.org/>.
- 98 "EPSRC has developed a number of strategic partnerships with companies and other organisations, to enable leading researchers to focus on user led strategic requirements. One is example is the £30 million strategic partnership between EPSRC and BAE systems which supports long-term basic research in the aerospace and defence sector"
<http://www.rcuk.ac.uk/innovation/fundingkt/collabres/collabreshigh.htm>
- 99 Letter from University of Bristol in response to an FoI Request, 11 May 2006.
- 100 *Ibid.*
- 101 *Ibid.*
- 102 *Ibid.*
- 103 See Section 1 for an explanation of this term.
- 104 DTI R&D, Commentaries- Gordon Page CBE, Chairman of Cobham PLC,
http://www.innovation.gov.uk/rd_scoreboard/commentary_2004_2.asp
- 105 FLAVIIR, Sponsors, <http://www.flaviir.com/sponsors.htm>
- 106 Ministry of Defence, Defence Technology Strategy, 2006, p.21
- 107 Ministry of Defence, Defence Technology Centres,
<http://www.science.mod.uk/frame.htm?http://www.science.mod.uk/pages/dtc.htm>
- 108 *Ibid.*
- 109 Defence Technology Strategy, op. cit.
- 110 Ministry of Defence, Defence Technology Centres,
<http://www.science.mod.uk/frame.htm?http://www.science.mod.uk/pages/dtc.htm>
- 111 SEAS DTC, Participants,
http://www.seasdtc.com/participants/part_other.htm
- 112 The present SEAS-DTC Board Chairman is Simon Jewell of BAE Systems.
- 113 Selex is a subsidiary of the Italian defence giant Finmeccanica. Selex was, until March 2007, jointly run by Finmeccanica and BAE Systems.
- 114 C. Langley, Scientists for Global Responsibility, Soldiers in the Laboratory, 2005, p.45
- 115 Engineering and Physical Sciences Research Council (EPSRC), Annual Report 2003-04, p.34
- 116 Engineering and Physical Sciences Research Council (EPSRC), Aerospace and Defence Sector Report, 2004
- 117 DTI, The National Defence and Aerospace Systems Panel (NDASP), February 2002
- 118 The ten universities are: Cranfield, Imperial, Leicester, Liverpool, Manchester, Nottingham, Southampton, Swansea, Warwick, York.
- 119 FLAVIIR, Home, <http://www.flaviir.com/home.htm>
- 120 FLAVIIR, Sponsors, <http://www.flaviir.com/sponsors.htm>
- 121 *Ibid.*
- 122 Imperial College London, News and Events,
http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/newssummary/news_20-9-2006-16-38-4
- 123 *Ibid.*
- 124 *Ibid.*
- 125 "Case Study: Rolls-Royce and the University Technology Centres," University of Sheffield,
<http://www.shf.ac.uk/business/portfolio/rr.html>
- 126 "Rolls Royce University Technology Centre," University of Nottingham, <http://www.nottingham.ac.uk/~epzutc/>
- 127 See Section 1 for an explanation of this term.
- 128 Cranfield University, Press Releases,
<http://www.cranfield.ac.uk/university/press/2005/25112005.cfm>
- 129 NB This is a selection from the military-related projects conducted at Leeds University's various departments.
- 130 Letter from University of Leeds in response to a FoI Request, October 2006
- 131 *Ibid.*
- 132 *Ibid.*
- 133 *Ibid.*
- 134 2006 Defense News Top 100,
<http://defensenews.com/index.php?S=07top100>
- 135 The RAE is used to assess the quality of research carried out in every university department in the country, so as to allocate 'quality-related' money to universities. This is the biggest source of research funding for universities and is crucial to their ability to function as more than purely teaching institutions.
- 136 A.Callinicos, Universities in a Neoliberal World, Bookmarks, 2006, p.20
- 137 While there has been a massive injection of money into universities under New Labour, the rapid rise in student numbers has led to the amount of state funding allocated per student falling steadily. Furthermore, the money that universities do receive is driven by the government's aim of harnessing knowledge to wealth creation – the logic of competition and profit so cherished by big business.

About CAAT and FoR

Campaign Against Arms Trade (CAAT)

Campaign Against Arms Trade (CAAT) was set up in 1974 by a number of peace and other organisations who were concerned about the growth in the arms trade following the Middle East war of 1973. It is a broad coalition of groups and individuals in the UK working to end the international arms trade. This Trade has a negative effect on human rights and security as well as on global, regional and local economic development. In seeking to end it CAAT's priorities are to:

- end government subsidies and support for arms exports;
- end exports to oppressive regimes;
- end exports to countries involved in an armed conflict or region of tension;
- end exports to countries whose social welfare is threatened by military spending;
- support measures, both in the UK and internationally, which will regulate and reduce the arms trade and lead to its eventual end.

CAAT recognises that, in a world of military alliances and transnational military industry, traditional national 'defence' no longer exists for the UK. Whilst within CAAT there is diversity of opinion on the general issues of military defence, non-violence and security, it is agreed that high military spending is unacceptable, and only reinforces a militaristic approach to problems.

CAAT supports the promotion of peace, justice and democratic values, and the use of the United Nations and civil society to resolve international disputes by peaceful means. CAAT also encourages policies to reorientate the UK economy away from military industry towards civil production.

Campaign Against Arms Trade
11 Goodwin Street
London N4 3HQ
Tel: 020 7281 0297
Fax: 020 7281 4369
Email: enquiries@caat.org.uk
Website: www.caat.org.uk

The Fellowship of Reconciliation

The Fellowship of Reconciliation (FoR) is an international, spiritually-based movement of people who, from the basis of a belief in the power of love and truth to create justice and restore community, commit themselves to active nonviolence as a way of life and as a means of personal, social, economic and political transformation. FoR is part of the International Fellowship of Reconciliation, which has 80 branches, groups, and affiliates in almost 50 countries on all continents. Today FoR, England:

- Undertakes education work within the Christian and wider community on peace, war and nonviolence;
- Seeks to identify the causes of violent conflict and raises public awareness of them, encouraging supporters and the public to challenge the structures, policies and attitudes that lead to violent conflict;
- Supports and affirms all those with a commitment to peace and nonviolence; and,
- Is committed to developing a spirituality of peace, justice and nonviolence in witness to Christian faith and gospel values.

Our campaigns and advocacy work is aimed at encouraging members, supporters and the public at large to be aware of and to challenge the structures, policies and attitudes that lead to violent conflict. Our education work includes the production of resources to enable a better understanding of nonviolence and reconciliation work as well as information to enable a greater understanding of specific peace and conflict issues. We provide speakers to groups, churches, universities, schools and the public on a variety of issues connected to our work.

Fellowship of Reconciliation
St James Church Centre
Beauchamp Lane
Oxford OX4 3LF
Tel: 01865 748 796
Email: office@for.org.uk
Website: www.for.org.uk