Addendum AA1. UK nuclear weapons R&D spending

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Summary

In this addendum to the SGR report, *Offensive Insecurity* (September 2013), we present an estimate of total UK government spending on nuclear weapons R&D, drawing on the data obtained for the report via freedom of information requests, and on further publicly available information about the different R&D spending streams.

The analysis reveals that the UK spent an average of £327m per year over the three years from 2008 to 2011. This included £106m/y on R&D related to Trident nuclear warheads, £127m/y on R&D for new 'successor' submarines to carry Britain's nuclear weapons, and £94m/y on R&D for a new nuclear propulsion system for these submarines.

We also compare the total annual spending on nuclear weapons with other areas of UK public spending on security-related R&D over this period, including those that help to tackle drivers of current and future conflict, such as climate change. One notable comparison is that UK public R&D spending for nuclear weapons technologies was more than five times that on renewable energy technologies during this period.

AA1.1. Analysis of data

A breakdown of the R&D spending data relevant to nuclear weapons – obtained via freedom of information requests to the MoD for the three-year period 2008-11, and summarised in the main report – is given in tables AA1.1-1.3. (The data provided here for 'Long-range submarines' is a more detailed breakdown than that given in appendix A3 to the report.)

There are two key areas of ambiguity in the spending figures: 'Long-range submarines' and 'Nuclear propulsion'. As discussed in chapter four of the main report, the R&D programme for both these areas seems to include work on both conventionally armed and nuclear-armed submarines.

Table AA1.1. MoD R&D spending programmes relevant to nuclear weapons, 2008-09 *(MoD, 2012; 2012b) (cash terms)*

Name	*Abbreviations*	*Code*	*Spending (£m)*
Long-range submarines (nuclear and conventionally armed)	Future Submarines/ FSM IPT/ Strategic Options Group	8367	74.3
	Sub-IPT	8086	1.3
	IPT-Torpedoes	8095	1.9
	UWS / Underwater Warfare Systems	6321	0.0
	IPT-Astute	8140	0.5
Nuclear propulsion (for submarines)	Nuclear propulsion	8151	65.6
Nuclear weapons (warheads)	na	na	104.0

Table AA1.2. MoD R&D spending programmes relevant to nuclear weapons, 2009-10
(MoD, 2012; 2012b) (cash terms)

Name	*Abbreviations*	*Code*	*Spending (£m)*
Long-range submarines (nuclear and conventionally armed)	Future Submarines/ FSM IPT/ Strategic Options Group	8367	188.9
	Sub-IPT	8086	0.1
	IPT-Torpedoes	8095	0.0
	UWS / Underwater Warfare Systems	6321	0.6
	IPT-Astute	8140	1.0
Nuclear propulsion (for submarines)	Nuclear propulsion	8151	101.3
Nuclear weapons (warheads)	na	na	110.0

Table AA1.3. MoD R&D spending programmes relevant to nuclear weapons, 2010-11
(MoD, 2012; 2012b) (cash terms)

Name	*Abbreviations*	*Code*	*Spending (£m)*
Long-range submarines (nuclear and conventionally armed)	Future Submarines/ FSM IPT/ Strategic Options Group	8367	109.8
	Sub-IPT	8086	2.7
	IPT-Torpedoes	8095	9.2
	UWS / Underwater Warfare Systems	6321	0.2
	IPT-Astute	8140	1.9
Nuclear propulsion (for submarines)	Nuclear propulsion	8151	115.0
Nuclear weapons (warheads)	na	na	103.0

Regarding the conventionally armed submarines, the first of the new Astute class was launched in 2007, and the second in 2011. Production of five others is either underway or planned, and these are being phased in as the existing Trafalgar class vessels are retired. The lion's share of R&D spending for the Astute class, including for its propulsion system, would therefore likely have been conducted before 2007.

Regarding the nuclear-armed vessels, four Vanguard class submarines are currently deployed – carrying Trident nuclear missiles – and development work is underway on a planned successor, which, if approved by parliament, is due to come into service from the late 2020s. The 'concept phase' for the Vanguard successor – which mainly consists of R&D – began in mid-2007 and ended in May 2011, and resulted in a total spend of about £900m (MoD, 2011) , an average of about £225m a year. This concept phase also led to the decision to use a new design of nuclear reactor for propulsion, the PWR3, for the successor submarines.

With our data covering the period April 2008 to March 2011 inclusive, we can see that the dominant focus of submarine R&D during this time will have been the nuclear-armed Vanguard successor programme and its propulsion system. Indeed, the total R&D spending

under the headings 'Future submarines' and 'Nuclear propulsion' closely mirrors the concept phase spending quoted above. This is reinforced by the fact that R&D spending explicitly for the Astute class submarines (code: 8140) is quoted separately and averages only about £1m per year. It is possible that some of R&D conducted under 'Future submarines' may be used for new conventionally armed submarines (which would eventually succeed the Astute class) through the Maritime Underwater Future Capability (MUFC) programme. However, this programme is still in its very early stages and, as late as 2012, was being described by the Defence Science and Technology Laboratory as "embryonic" (DSTL, 2012).

There is no publicly available information on the small 'Sub-IPT' programme, and the two torpedo-related programmes ('IPT-Torpedoes' and 'UWS / Underwater Warfare Systems') seem to be relevant to both conventionally and nuclear armed vessels.

The R&D spending explicitly earmarked under the heading 'Nuclear weapons' is very likely to be focused completely on nuclear warheads at the Atomic Weapons Establishment (AWE). This view is consistent with the major upgrade in R&D facilities that has been carried out at the AWE in recent years. All R&D work on Trident nuclear missiles is carried out in the USA (as this is where the missiles are designed and manufactured), hence this will not be included under this heading.

AA1.2. Estimating the total UK R&D spending on nuclear weapons

In order to estimate a total figure for the UK public R&D spending on nuclear weapons and essential support systems for the three-year period 2008-11, we have allocated a percentage of the costs of the different R&D programmes as shown in table AA1.4. This is based on the discussion in the preceding section.

Table AA1.4. Estimated percentages of MoD programme spending for UK nuclear weapons system

Name	*Abbreviations*	*Code*	*% for nuclear arms*
Long-range submarines (nuclear and conventionally armed)	Future Submarines/ FSM IPT/ Strategic Options Group	8367	100%
	Sub-IPT	8086	50%
	IPT-Torpedoes	8095	50%
	UWS / Underwater Warfare Systems	6321	50%
	IPT-Astute	8140	0%
Nuclear propulsion (for submarines)	Nuclear propulsion	8151	100%
Nuclear weapons (warheads)	na	na	100%

This results in the annual totals given in table AA1.5.

Table AA1.5. MoD R&D spending relevant to nuclear weapons, 2008-11 (calculated using data in tables AA1.1-AA1.4) (cash terms)

£m	2008-09	2009-10	2010-11	2008-11 average
Nuclear-armed submarines	75.9	189.3	115.8	127.0
Nuclear propulsion for nuclear-armed submarines	65.6	101.3	115.0	94.0
Nuclear warheads	104.0	110.0	103.0	105.7
Total	***245.4***	***400.5***	***333.8***	***326.6***

Thus we estimate that the UK government spent an average of £326.6m per year on nuclear weapons R&D over the three-year 2008-11.

AA1.3. Implications for policy

The public R&D spending on the UK's nuclear weapons system revealed by this analysis – over £320m per year during the three-year period 2008-11 – exceeds that for any conventional weapons system, the largest R&D budgets for these being strike planes (£257m/y) or attack helicopters (£200m/y) – see chapters three and four.

Comparisons with key areas of public spending on civilian R&D that help to tackle root causes of conflict are even more stark. For example, R&D spending on renewable energy – crucial for improving energy security and tackling climate change – was only £60m/y over the same period (see chapter five).

Advocates of the nuclear weapons spend may point to valuable R&D work carried out by the AWE in support of nuclear disarmament efforts but, as pointed out in the main report (chapter four), this is estimated to amount to only £12m/y.

It should also be noted that since 2011, this annual R&D spending would likely have increased as the nuclear-armed successor submarine programme moved from 'concept phase' to 'assessment phase'. (The spending data for this programme for the years after 2011 is not yet publicly available.) This is against a background of major public spending cuts.

This analysis reinforces the conclusions of the main report that UK public spending on scientific research and technological development is supporting an aggressive approach to security problems, and a shift in R&D spending could and should be undertaken as part of a wider strategy to tackle the roots of insecurity.

References

NB only references not included in the main report are listed here

DSTL (2012). Future Underwater Systems. DSTL presentation, January. http://www.science.mod.uk/controls/getpdf.pdf?657

MoD (2011). The United Kingdom's Future Nuclear Deterrent: The Submarine Initial Gate Parliamentary Report. May.

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Main report:
Parkinson S, Pace B, Webber P (2013). Offensive Insecurity: The role of science and technology in UK security strategies. Scientists for Global Responsibility. http://www.sgr.org.uk/publications/offensive-insecurity

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