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Enough warheads, already

Its official: the reliability of existing US nuclear warheads makes their replacement unnecessary.

This week, UK prime minister Tony Blair declared his intention to replace the Trident submarine fleet that carries Britain's nuclear weapons. His declaration has sparked a debate in Britain about the role of nuclear weapons in the modern world — and about the obligation of states with nuclear weapons to move towards disarmament under the 1968 Nuclear Non-Proliferation Treaty (NPT).

But as Britain ponders its submarines, the United States is conducting a lower-profile but even more fundamental debate on whether to replace the nuclear warheads themselves. Over the past five years, some US weapons specialists have pushed a variety of new weapons concepts. But since the end of the cold war, making the case for brand new nuclear weapons has, thankfully, been a tough sell.

In Congress, liberals tend to argue that such weapons would defy the NPT. Conservatives see them as overly expensive. The military is happy with the nuclear weapons it already has, and the president, like his predecessors, wishes to continue a voluntary moratorium on nuclear testing.

But supporters of new and improved nuclear weapons are nothing if not tenacious. These days their main vehicle is a proposed project to build a Reliable Replacement Warhead (RRW). The argument for its pursuit goes, taking the words in reverse order, like this. It is a warhead, so it would require the nuclear-weapons labs to bring their collective knowledge to bear on its design and production. But it is merely a replacement, not a new design, so it won't violate international obligations, and won't, it is said, require full testing. And it is reliable — the clear implication being that existing warheads are not, or will not be in the near future.

It was this last argument that gave some urgency to the RRW programme. When the idea was conceived, it was estimated that the plutonium 'triggers' that fire the existing nuclear warheads might last only 40–60 years. As most of them are already 20 years old, it could be argued, it was time for the laboratories to start work right away on finding a reliable replacement.

Unfortunately for advocates of the programme, however, it has emerged that existing warheads are more reliable than envisaged. Last week, the US National Nuclear Security Administration, which manages the nuclear-weapons programme, released unclassified summaries of two studies that found that the existing plutonium triggers will last for up to a century (see page 660). And that's in the worst case —the triggers may well last even longer.

Advocates of the replacement programme inside the Bush administration are apparently undaunted. Speaking through the Nuclear Weapons Council, which comprises the leaders of the agencies in the federal government that have an interest in these matters, they argued that the principal role of the RRW would, in fact, be to augment the security and safety of existing warheads. But these things are already more than adequately assured, through the decade-old stockpile stewardship programme.

Even before the new studies were released, the RRW seemed to be stuck in Congress. With Democrat gains in last month's mid-term elections, its prospects are bleaker still. Already, two senators, Jeff Bingaman (Democrat, New Mexico) and Dianne Feinstein (Democrat, California), have made their opposition to the programme clear. The political will to pursue it simply isn't there.

That's just as well. No convincing case has been made for the United States to replace its existing nuclear warheads. Their dreadful function is dependent on principles that were proven 50 years ago and aren't going to change any time soon. The government should give up its desire for new designs and settle on a size and shape for a research programme that fits the less extravagant needs of its existing nuclear-weapons stockpile — a stockpile that, with luck, will become obsolete before it needs to be replaced. ■

A fair share

The concept of sharing primary data is generating unnecessary angst in the psychology community.

In psychology there is little tradition of making the data on which researchers base their statistical analyses freely available to others after publication. This makes it difficult for anyone to independently reanalyse research results, and prevents small data sets from being combined for meta-analysis, or large ones mined for fresh insights or perspectives.

Psychologists need to rethink their reluctance to share data. Their discipline is 'softer' than some others: rarely do data on issues such as playground bullying or the usefulness of psychotherapy reveal really clear-cut answers. This makes the rigour with which the data are handled fundamental to research outcomes — and increases the desirability of having them open to examination by peers.

The need for more data sharing has just been amply demonstrated by Jelte Wicherts, a psychologist specializing in research methods at the University of Amsterdam, who tried to check out the robustness of statistical analyses in papers published in top psychology journals.

He selected the November and December 2004 issues of four journals published by the American Psychological Association (APA), which requires its authors to agree to share their data with other researchers after publication. In June 2005, Wicherts wrote to each corresponding author requesting data, in full confidence, for simple reanalysis. Six months and several hundred e-mails later, he abandoned the mission, having received only a quarter of the data sets. He reported his failure in an APA journal in October (J. M. Wicherts *et al. Am. Psychol.* **61**, 726–728; 2006).

Researchers often have valid reasons for constraining access to their raw data, such as the privacy of research subjects. But data from most studies based on confidential information can be coded in a way that will guarantee their subjects' anonymity. The few cases where this is not possible can be exempted from the move towards data sharing.

A second factor deterring openness is a natural desire to retain exclusive access to data that took years of care and attention to collect. Like many researchers in other disciplines, psychologists fear that if different analytical approaches are brought to bear on their data, different conclusions could be drawn, casting doubt on their competence — or even their integrity. But in most cases, if data have been collected, selected and analysed correctly, researchers have little to fear in this regard, and the resulting discussion is likely to prove enlightening for the field as a whole.

An associated concern is that data could be wilfully misinterpreted by anyone with a political agenda. But this should not prevent the sharing of data sets: false interpretations of the data will fail to find any foothold in the community as whole.

A less frequently articulated reason for resistance to data sharing is the fact that some researchers are simply unable or unwilling to record and present their data in an unambiguous, reader friendly and archivable form.

The APA's editors and publishers are now planning their response to Wicherts' report. One result should be the acceleration of moves, already under discussion, to require the deposition of data as supplementary electronic material in APA databases. Where the APA leads, other psychology journals are likely to follow.

Granting bodies must also play a part. In 2003, the US National Institutes of Health introduced rules requiring the public sharing of data in psychology studies for grants exceeding $500,000, allowing exemptions where confidentiality issues cannot be circumvented. Other agencies should follow suit. And university departments need to do more to teach the basics of note-keeping and data presentation, to prepare their students for an era in which data sharing will increasingly become the norm. ■

Green shoots of growth

Energy from biomass is an idea whose time has returned.

Until the twentieth century, biomass was humanity's principal source of energy, heating our stoves and feeding our draught animals. Even today, roughly 10% of all our energy comes from biomass — far more than from any other renewable energy source or, for that matter, from nuclear fission.

But this use of biomass for energy supply is accompanied by many challenges (see page 669). For one thing, it is often not all that renewable — the biomass sources that provide firewood to the world's poor, for example, are not being replanted. For another, it is very inefficient: gathering firewood takes a long time. The history of the past couple of centuries has been in large part one of people moving away from biomass as soon as they can afford to do so.

Three recent developments have spurred renewed interest in biomass, however. One is the need to reduce greenhouse-gas emissions. The requirement for other external energy inputs during biomass processing means that it often involves some net carbon emissions — but the amount of carbon dioxide given off by burning biomass is the same as that taken from the atmosphere by photosynthesis in the first place. If biomass projects could sequester carbon, either by enriching the soil beneath plantations or by storing any carbon dioxide produced in combustion, they could even be carbon negative — a unique selling point for this energy source.

The other two developments are the upward movement in the prices of oil and natural gas, and the related revival of concerns about the security of their supply. Most nations are seeking home-based energy sources that do not rely on political stability in the Middle East or Russia.

It seems unlikely that these factors will provide sufficient impetus to propel biomass energy to the very front rank of possible alternatives to fossil fuels. But biomass clearly has a potential role as part of a portfolio of energy sources for the twenty-first century.

If that role is to be fulfilled, two things need to happen. Nations have to build regulatory mechanisms that recognize the carbon benefits of technologies such as biomass — through emissions pricing, a carbon tax or a combination of the two. And intensive research needs to be conducted into both the efficient production of biomass and its conversion into useable energy.

One focal point for such research should be finding ways to grow biomass quickly and in an easily processed form while minimizing external inputs, such as fertilizer and pesticides. Another is the systems engineering of farms and ecosystems, finding ways to fit biomass projects into and around present land use and possible changes in farming practice.

A major attraction of biomass is that it is likely to benefit poorer countries, which tend to be in tropical regions where plants grow quickly. There is plenty of scope for more collaboration between developing countries on biomass research and development, both to meet local needs and for export.

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But this requires consideration of the local and global ecological impact of biomass expansion. Vast tropical monocultures eating away at primary forests — as exemplified by the production of palm oil in Indonesia — will benefit no one, except those who profit from selling the fuel. In effect, such approaches take green subsidies from richer countries, and use them to despoil the tropics.

Similar problems afflict existing biomass programmes in the United States, where ethanol refineries often burn fossil fuel and are reliant on subsidized corn monoculture. More innovative approaches would include firing the refineries with agricultural waste, and feeding them with plants of many different species. Biomass energy should be developed energetically, but within the context of appropriate environmental policies, and using approaches that are both sustainable and cost-effective. ■