
Physics and weapons

The following two articles were submitted to us, independently, by Professor K E Puttick, and Professor M V Berry and Dr P J Shepherd. We are publishing them together because of the importance of the subject, and to encourage our readers to add to this discussion.

Physicists and the arms race

If nuclear bombs are ever again exploded in anger, a minor effect in addition to the terror and misery might well be the destruction of physics as a flourishing and proud profession. For who would then confidently admit to being members of a group which created and was indispensable in developing and refining humanity's first weapons of mass annihilation? In this matter, physicists have a unique responsibility and should fully participate in current debates on weapons policies. It is not sufficient to confine ourselves to dispensing technical information – to do that would be to play the role of detached 'experts' with no involvement in what is going on. It is necessary to do more, and we hope by writing this article to promote or provoke discussion within the profession between those opposed to weapons research and those doing it. To start this discussion we now give our own opinion.

Physicists who work for the military are part-time soldiers. They should not seek to justify their work on the grounds that they share the ideals and methods of the wider scientific community – open-minded analysis of evidence, testing theories with experi-

ments, etc. Soldiering has its own justification in terms of military strategy. Until now the strategy underlying nuclear weaponry has been deterrence. Although we consider this policy to be immoral and precarious as a basis for national security, it is fairly clear, at least in its essentials: 'Our forces of retaliation are invulnerable and overwhelming, so any first strike on our cities or military installations is guaranteed to result in the destruction of yours'.

But those military physicists who have regarded their research as helping to deter potential aggressors should reckon with the fact that their technical ingenuity now undermines the very concept of deterrence. Amongst these destabilising developments are:

- (i) Missiles (e.g. Cruise, Pershing, MX) with accuracies essential for first strikes against hardened missile silos but far in excess of what is required for deterrence;
- (ii) Space-based ABM systems, which if successful could also make a first-strike strategy a 'rational' possibility;
- (iii) Antisubmarine-warfare technology designed to end the invulnerability of submarine deterrent forces;
- (iv) Nuclear weapons of ever smaller yield, to service the strategies of those advocating the feasibility of 'limited nuclear war'.

We believe such developments to be the prime moving force behind the United States' and Nato's (and, for all we know, the Warsaw Pact's) gradual shift away from strategies of nuclear deterrence towards strategies of nuclear-war fighting. Thus, whatever their private rationalisations might be, the military physicists are direct instigators of changes in military policy, in this case profoundly dangerous. The danger is all the greater in view of the near-total impotence of arms control negotiations in the face of the fertility of scientific and technical invention. No doubt our colleagues in military

research laboratories are inspired by patriotism and a desire to contain communism, but their activities are threatening rather than enhancing our national security. We are patriotic too, and unsympathetic to the Soviet system, but believe that other military (and nonmilitary) policies, which do not require the development of new nuclear weaponry, would better safeguard our country and way of life. We do not propose here to elaborate on these alternatives, and in any case this would take us too far from our main point, which is the following:

At its best, our beautiful subject brings us close to the physical world and helps us work in harmony with its laws to improve our lives. It is the ultimate perversion to employ these laws in the service of mistaken strategies (such as invincibility through unlimited destructive power) by devising instruments that are capable of being unleashed by someone remote from the consequences of his (or, less plausibly, her) action and can sacrifice, in a flash and in lingering despair, millions of noncombatants.

Discussion of how to react to the threatened breakdown of deterrence should not be allowed to founder on the difficulty of drawing a precise distinction between military and nonmilitary research. In a complex society, any activity, and not just science, is likely to produce unforeseen or unwelcome results (e.g. steel workers' products can be used to make bombs, guns and knives, and teachers may instill literacy in children who grow up to become demagogues and dictators). Such uncertainty is no excuse for inaction, and indeed there are several ways in which the implicit consensus supporting weapons development can be challenged.

First, we can personally refuse to participate in research whose expressed aim is weapons development. Secondly, those in nonmilitary institutions can advocate the policy (adopted

by Bristol University some years ago) of not permitting research to be funded by sources restricting the free publication of results. Thirdly, if our own research has not been funded by any military agency we can append a declaration to this effect in the 'acknowledgments' section of our publications, thus drawing attention to the fact that a great many papers include some expression of gratitude to military sponsors. Fourthly, we can try to persuade our colleagues involved in weapons research that their misapplied ingenuity is accelerating our race towards oblivion and would be better applied to nonmilitary ends. These proposals might seem ineffectual, but in the face of what amounts to a pervasive corruption in our profession we have to begin somewhere □

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Letter to a Soviet physicist

Dear Mikhail

As I write, highly trained men around the world on land, under sea and in the air are patiently scanning instruments for a signal to destroy your country and mine. The weapons at their command, developed by physicists, have the power to bring to an end that Renaissance civilisation of which science is perhaps the greatest and most characteristic achievement; you and I therefore share with all members of our profession a double responsibility to warn our peoples and their leaders of the great and increasing danger in which they stand.

From the very first test of a nuclear weapon it should have been clear that an entirely new situation existed in international relations, a crisis which could be met only by new ways of resolving conflict. That was indeed well understood by the pioneers of modern

physics whose research provided its basis, Einstein and Bohr especially. Those great scientists, however, failed to convert to their view the politicians and the military men of the time. The old attitudes, the time-worn prejudices and enmities reasserted themselves, reproducing the atmosphere which precipitated the First World War and described by a statesman of that period in these words: 'Fear begets suspicion and distrust and evil imaginings of all sorts, till each government feels that it would be criminal and a betrayal of its country not to take every precaution, while every government regards the precautions of every other government as evidence of hostile intent'. Within a few years certain physicists actively involved in armament development (Oppenheimer in the USA and Sakharov in the USSR) tried to reverse the trend in the politics of threat and aggression; their advice was ignored and they suffered severe penalties in their careers. Meanwhile the number and power of bombs, the sophistication and accuracy of delivery systems continued to grow with dreadful vitality, beyond the demands of armies themselves, beyond any justification in terms of national safety, to a level which can be described as literally insane.

On both sides of the divide which separates us, discussion of the certain consequences of nuclear war is still officially discouraged. Defence is still described in terms, now archaic, of fighting for 'one's country', for 'freedom', as though fighting were not now synonymous with annihilation not of divisions and machines but of an entire way of life. Yet I believe that ordinary people are beginning to understand, in a way in which governments do not, and to hunger for a way out of this desert of fear. Responding to this feeling, other professions are trying to give a lead: groups of medical workers, for instance, like those from many lands at the 30th Pugwash conference who

stated: 'nuclear weapons are so destructive to human life and health that they must never be used. Prevention of nuclear war offers the only possibility for protecting people from its medical consequences. There is no alternative'. Is it not time for physicists once again to reinforce this message?

I am aware that governments are officially in favour of 'peace'. Some even sponsor 'peace movements', while continuing by their actions to increase the chances of war. Such movements, which lay the blame for this terrible predicament on one side or other only of the ideological conflict between East and West, should be shunned by us; our duty is to help to educate our fellow citizens and our political leaders in the inescapable facts relating to modern warfare, thermonuclear missiles in particular, and to promote by all possible means that climate of real understanding and tolerance which can alone ensure our survival.

Historians attempt to trace the origins of great changes in human affairs to the intellectual currents of preceding years. What, I wonder, is prefigured by the interest of so many of our best minds in extreme forms of discontinuity: by mathematicians in certain significantly named topological singularities; by astronomers in cosmological boundaries beyond which normal physical laws cannot be assumed; by geologists in that sudden disappearance of species at the end of the cretaceous era; by archaeologists in the social and cultural disintegration following the collapse of the Western Roman Empire? Let us hope that those catastrophes and black holes, those extinctions and dark ages, are not after all the fatal omens they seem; let us hope also that our science, which played an outstanding part in the creation of this peril, will through its workers bring about its removal □

Yours sincerely
Keith