3.

10 DOWNING STREET

PRIME MINISTER

NEUTRON BOMB

I showed you the letter from Lord Zuckerman about the neutron bomb at Flag A while we were in Washington, but I did not believe you had time to read it.

Sir Robert Armstrong has now submitted comments from Dr. Press on Lord Zuckerman's thesis (Flag B).

I doubt whether it would be sensible for you to engage with Lord Zuckerman in a discussion of the merits or otherwise of the neutron bomb, and I therefore suggest that you send him a simple reply on the lines of the letter immediately below.

FRS.

9 March 1981

PERSONAL

Ref. A04412

MR WHITMORE

Mary A.

Just before we left for Washington I forwarded to you a letter which Lord Zuckerman had sent to the Prime Minister about the LBW (low blast weapon).

--- 2. You may like to see the attached copy of a note by Dr Press, commenting on Lord Zuckerman's letter.

Prime Minister.

RCA

ROBERT ARMSTRONG

9 March 1981

PERSONAL

B

to action

PERSONAL

SIR ROBERT ARMSTRONG

Thank you for your minute A04333 of 25th February inviting my comments on a letter dated 12th February 1981 from Lord Zuckerman to the Prime Minister.

2. Lord Zuckerman's letter ostensibly concerns the so-called 'neutron bomb' but in doing so he coalesces three issues. The first is a recurring debate about the overall utility of battlefield tactical nuclear weapons - whatever their nature. The second is the continuing problem of matching defence spending to the cost of ever-increasingly complicated and competitive weapon systems, whatever their intended role. The third is the 'neutron bomb' itself. I presume my comments are requested in respect of the latter and particularly in view of the wide misunderstandings that have arisen about its origin, its effects, its military utility and whether it should be produced and deployed.

3. The case for or a gainst a particular weapon should, in my view, be supported by a fuller exposure of the characteristics of that weapon than is given in a letter apparently directed mainly against the use of any nuclear weapons in battlefield situations. This same lack on the part of media reporting has led to much public emotion and heat rather than light about the 'neutron bomb'. To avoid the same omission in this minute, I include an Annex setting out the relevant characteristics of an enriched radiation warhead (popularly known as the 'neutron bomb'). To do so is not to claim that perceived military advantages, or claims for possibly enhanced deterrence, necessarily outweigh the general case against the escalating risks of using any tactical nuclear weapons in a battlefield situation.

4. The historical references in the unnumbered paragraphs 2 and 3 of Lord Zuckerman's letter seem to me misleadingly abbreviated. Whatever the part played by individuals singled out, the references appear to discount the original impetus from basic research in radiation enhancement carried out

PERSONAL

under the United States Atomic Energy Commission (then the responsible Government Agency for nuclear weapon research and development): the associated studies elicited by the United States Department of Defense and a formal recommendation "to ensure early and timely development of nuclear weapon systems which maximise prompt radiation".

5. Unnumbered paragraph 3 does not make clear whether it was the so-called neutron bomb that was specifically "voted down on scientific and military grounds" prior to 1972-73 or whether it was tactical nuclear weapons as a total category, when the then United States Secretary of Defense (Mr. McNamara) concluded that a European theatre nuclear war would be a losing battle for both sides. He then ruled against a new generation of tactical nuclear weapons, although he did accept the nuclear armed Lance missile because of its longer range. That in itself must have imposed dimensions much more compatible with an ERW than a SFW. If Mr. McNamara's action was the "voting down" referred to it was reversed under subsequent Secretaries of Defense - Mr. Laird, and particularly Mr. Schlesinger who, in 1973, with emphasis on flexible deterrence, re-opened interest in the possibilities of enhanced radiation warheads. His action led on to the present situation, including the development of an enhanced radiation warhead for the Lance missile.

Standard fission weapon

6. In unumbered paragraph 4, the quotation from an as yet unpublished United Nations report contains nothing that does not follow from the known one-sixth, one-third and one-half power relationship described in paragraph 4 of my Annex to this minute. As presented, the quotation fails to inform the reader that proponents of an enhanced radiation warhead do not claim value for it at anything other than a very low yield - certainly not at intermediate or large yields. I have not seen data to enable me to comment on manufacturing costs but I wonder how the "more constraints" statement fits the fact that United States plans are to deploy the enhanced radiation warhead with the Lance missile.

7. The remaining unnumbered paragraphs in Lord Zuckerman's letter fall mainly within the two continuing issues to which I have referred earlier in this minute and which I have not seen as within the scope of these comments.

8. It is not clear, from his letter, whether Lord Zuckerman's disapproval of the "neutron bomb" is based specifically on its nature and characteristics, or on his case against the deployment of any tactical nuclear weapons in battlefield situations. If the weight of argument finally favours the latter then, in that context, there would obviously be no point in adding enhanced radiation warheads to the spectrum of nuclear weapons already available. But if tactical nuclear weapons are to be deployed in battlefield situations, then quite apart from the dimensions of what can be delivered by the Lance missile or other artillery, should one forgo opportunities to minimise significantly the collateral damage arising from their use? What 'humanitarian' reasons could be advanced for then favouring the use of higher yield standard fission weapons to achieve the same military effect as enhanced radiation weapons of yield lower by about one order of magnitude?

(R. Press)

2nd March 1981

ANNEX

Enhanced Radiation Warhead Characteristics

1. An "enhanced radiation warhead"(ERW) - widely but imprecisely known as the "neutron bomb" - does not embody a new principle, as appears to be publicly perceived. The concept has been known for more than twenty years and enhanced radiation devices have been under development since the early 1960's. (The first test of one such was, I think, in 1963.) An ERW is a nuclear warhead designed to produce significantly more and/or higher energy output(s) of neutrons, or X-rays, or gamma rays, or a combination of these initial nuclear radiations, than would be produced by a normal or standard fission warhead (SFW) of the same total yield. It produces lower levels of blast and thermal energy output relative to the initial (prompt) nuclear radiation.

2. In a standard fission warhead the partition of total energy output(yield) would be as 5: 10: 50: 35 per cent for initial nuclear radiation, residual radiation, blast and thermal energy respectively; for a hypothetical enhanced radiation warhead the corresponding partition of energy would be as 30 : 5 : 40 : 25 per cent. It is this considerable increase in initial nuclear radiation, simultaneously with the reductions in other forms of energy output, that has caused the design of such a device to be called an "enhanced radiation warhead". It could have been called a "reduced blast" warhead and might have inspired much less public opposition if it had been!

3. All nuclear detonations emit neutrons, as well as blast and thermal energy. The fundamental distinction between an ERW and other more fission-dominated nuclear warheads, of very low yield, is that the fusion process utilised in an ERW causes the higher proportion of initial nuclear radiation, in the total energy release, to contain neutrons of higher but fixed energy. Their energy is fixed by the nature of the nuclear processes occurring in the warhead and their range in air is governed mainly by their initial energy. Thus, even as the total yield of a warhead is increased the lethal range of the neutrons is not significantly increased.

4. Whereas the lethal range (about 1300 metres) of ERW neutrons, plus the gamma radiation created by the neutrons interacting with surrounding atoms, increases only as the one-sixth power of increasing yield, the damaging effects

of blast and heat increase as the one-third and one-half power respectively. They, therefore, relatively rapidly become the major effects of nuclear detonations of increasing yield. Thus, for an increase of a factor of ten in yield, the increase in range for initial radiation effects would be by about 40 per cent while it would be about 100 per cent for blast effects and about 200 per cent for thermal effects. Hence an ERW of high yield would become indistinguishable from a standard fission warhead in gross effects and would make no practical sense. Its potentially major military effect is therefore limited to low yield tactical devices in specific battlefield situations, where troop safety distances for radiation effects would be relatively small, as would the distances at which effects on non-combatants would tend to insignificance.

5. The main military selling point for the ERW concept is that, since initial nuclear radiation would be the main mechanism for producing combat ineffectiveness among troops with a degree of protection against blast and thermal flash, calculation shows that a one kiloton enhanced radiation warhead could kill about twice as many tank crew men as a ten kiloton standard fission warhead, and with blast damage limited to an area about one-fifth as large. An ERW can also of course be more readily adapted to the Lance missile or other artillery.

6. The term "residual radiation", used earlier in this Annex, refers to radiation from fission products in debris clouds and then fall-out after a nuclear detonation has taken place. As a side advantage of ERW, it may be noted that the quantity of fission products per kiloton of total yield would be much reduced for ERW detonations while, at the same time, the reduction factor of ten in yield, relative to a SF detonation to achieve the same military effect, would further reduce the total formative of fission products.

7. In sum, the enhanced radiation warhead, or so-called ' 'neutron bomb', when seen in a strictly military context could be regarded as a 'reduced blast' weapon producing a high level of combat ineffectiveness in enemy troops while simultaneously reducing collateral damage from blast and thermal effects: improving safety distances for one's own troops: reducing fission product fall-out, particularly at longer range, and also casualties to non-combatants in areas near the combat zone. It is not a new concept giving rise to phenomena of increased destructive capability when compared with the current range of nuclear weapons.

2nd March 1981