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MINISTRY OF DEFENCE

MAIN BUILDING WHITEHALL LONDON SW1

Telephone 01-908 7022 218 2111/3

Prime Minister.

You asked for some papers
 which Lord Zuckerman showed you
 before I came to No. 10. We are not
 having much success in finding them.
 Can you give me any more guidance?

9th April 1984

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SOVIET FEARS OF A PREEMPTIVE NUCLEAR ATTACK

You wrote to me on 26th March about some American studies on the likely course of developments on the ground in the early stages of a nuclear war. We have had some difficulty in locating precisely what the Prime Minister recalled. I therefore asked Lord Zuckerman's office whether they could recall what the Prime Minister has in mind and Lord Zuckerman in turn himself contacted me. I attach a copy of a self-explanatory letter from him of 3rd April together with its enclosures. I do not believe, however, that this is what the Prime Minister wanted: if she wishes to pursue the point, would it be possible to give me some further details?

My apologies for not being more helpful.

Yours etc,

R. Charles Mottram

(R C MOTTRAM)
 Private Secretary



The Zoological Society of London

President: Professor Lord Zuckerman,
OM, KCB, DSc, FRS

Secretary: Professor J G Phillips,
PhD, DSc, FRS

Regent's Park
London NW1 4RY

Tel: 01-722 3333

3 April 1984

BFH

R C Mottram Esq
Private Secretary to the Secretary of State for Defence
Ministry of Defence
Main Building
Whitehall
London SW1

Dear Mottram

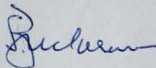
I cannot recall to what precise piece of paper the Prime Minister was referring. Most of the American studies were carried out under the aegis of one of Bob McNamara's Assistant Secretaries called Enthoven during the sixties. We ourselves had done some more direct studies in the days before the 'computer' took over. By direct study, I mean pitting one divisional commander against another in the old-fashioned way when both, with their teams, operated from separate quarters furnished with vast three-dimensional relief models of hundreds of square miles of terrain. At the start of each game, the respective commanders were furnished with a limited amount of intelligence about the other side's dispositions and, once the whistle blew, the various moves which they made with the troops and armour at their disposal, were reported back to the umpires' vast room and map, on which the actual positions of the two sides were plotted from minute to minute. Nuclear weapons were used in these games.

Some years ago, I asked to see some of the reports of these exercises, but it turned out that no one knew where they were. The same applied to some very detailed studies which I directed into the consequences of a nuclear attack on centres of population. All I have now are the references of our studies which appeared first in a book of mine published in 1966 (which embodied the Lees-Knowles lectures of the previous year). I attach a photocopy of the relevant pages. The same material was made available to a UN report, also attached, which was pulled together by an international party on which I was the UK representative.

Continued/....

More important are two pages from a book recently published in the United States by Bernard O'Keefe. He, as you will see, was one of a small party who witnessed an explosion of the only nuclear shell that was ever fired into the atmosphere. Until I read his book I was unaware of the fact that no more than one such weapon had ever been fired. It is all but impossible to conceive of what the picture would be given that not one, but tens or even hundreds of such weapons, were ever detonated in a zone of battle.

Yours sincerely

A handwritten signature in blue ink, appearing to read "Zuckerman". The signature is fluid and cursive, with a large initial "Z".

Lord Zuckerman

Encs

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cc Sir P Cradock

10 DOWNING STREET

From the Private Secretary

26 March 1984

SOVIET FEARS OF A PRE-EMPTIVE NUCLEAR STRIKE

You will see from a separate letter which I have written today to Roger Bone that the Prime Minister wishes to hold an early meeting to consider a JIC report on the above subject.

The Prime Minister recalled today that in, she thinks, her first year of office Sir Solly Zuckerman made available to her some American studies on the likely course of developments on the ground in the early stages of a nuclear war. Mrs Thatcher gave me the impression that these studies were on Ministry of Defence files. She would like to see these again - I shall be grateful if you could make them available.

ATC

Richard Mottram Esq
Ministry of Defence

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Department of Political and Security Council Affairs

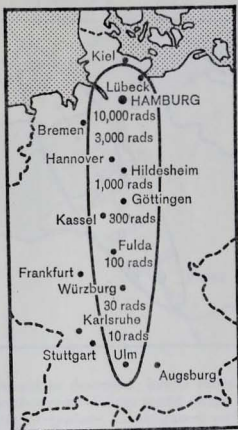
**EFFECTS OF
THE POSSIBLE USE
OF NUCLEAR WEAPONS AND
THE SECURITY AND ECONOMIC
IMPLICATIONS FOR STATES
OF THE ACQUISITION AND
FURTHER DEVELOPMENT
OF THESE WEAPONS**

**Report of the Secretary-General
transmitting the study
of his consultative group**



UNITED NATIONS
New York, 1968

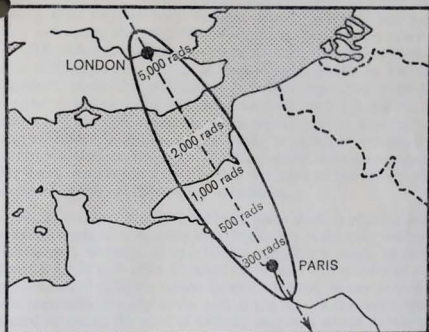
FIGURE VI. ESTIMATED FALL-OUT CONTAMINATION AREA AFTER 20-MEGATON NUCLEAR EXPLOSION ON HAMBURG. RADIATION DOSE IS GIVEN FOR 48 HOURS AFTER DETONATION



EFFECTS ARISING FROM THE USE OF NUCLEAR WEAPONS
IN FIELD WARFARE

31. In certain quarters it is still military doctrine that any disparity in the conventional strength of opposing forces could be redressed by using nuclear weapons in the zone of battle. This proposition needs to be considered first in the context that both sides possess these weapons, and second when the situation is asymmetrical and only one side is a nuclear weapons Power. Section III of this report deals with the latter case. In the former, where the situation is symmetrical, carefully conducted and dispassionate theoretical studies of the use of nuclear weapons in field warfare, including analyses of an extensive series of "war games" relating to the European theatre, have led to the clear conclusion that this military doctrine could lead to the use of hundreds, and not of tens, of so-called tactical nuclear weapons in the battlefield area, given that both sides resort to their use. Without going into the details of these studies, it can be firmly stated that, were nuclear weapons to be used in this way, they could lead to the devastation of the whole battle zone.

FIGURE VII. ESTIMATED FALL-OUT CONTAMINATION AREA AFTER A 15-MEGATON NUCLEAR EXPLOSION ON LONDON. RADIATION DOSE IS GIVEN FOR 36 HOURS AFTER DETONATION



Almost everything would be destroyed; forests would be razed to the ground and only the strongest buildings would escape total destruction. Fires would be raging everywhere. Circumstances such as these would be incompatible with the continued conduct of military operations within the zones of devastation.

32. An offensive on the scale to which all these studies point, over a land battle area with a front of, say, 250 km and 50 km deep, would render hundreds of thousands, even millions, homeless. Such a level of destruction could be achieved with only 100 small nuclear weapons in a European battle area chosen because it did not contain any large towns. With 400 weapons, which is not an unreasonably large number if both sides used nuclear weapons in a battle zone, the physical damage caused would correspond to something like six times that caused by all the bombing of the Second World War—and all sustained in a few days rather than a few years. If one sets aside the profound, even if unquantifiable psychological effects of such an exchange, the resulting chaos would still be beyond imagination.

33. The estimates show that with 100 weapons having an average yield of thirty kilotons (range 5 to 50 kilotons) about one tenth of the assumed typical European battle area would be completely devastated, and about one quarter severely damaged. With 200 weapons about one fifth would be devastated and half of it severely damaged; and with 400 weapons about one third of the area would be devastated and all severely

damaged. Even for only 100 strikes, this represents destruction on an unimaginable scale over an area of about 12,500 sq. km. In another European "war-game" study, a battle was envisaged in which the two opposing sides together used weapons whose total yield was between twenty and twenty-five megatons, in not fewer than 500 and in not more than 1,000 strikes. The nuclear weapons were supposed to have been used against military targets only, in an area of about 25,000 sq. km. In this engagement about 3.5 million people would have had their homes destroyed if the weapons had been air-burst, and 1.5 million if the weapons had been ground-burst. In the former case, at least half of the people concerned would have been fatally or seriously injured. In the case of ground-burst weapons, 1.5 million would have been exposed to lethal doses of radiation and a further 5 million to the hazard of considerable although non-lethal doses of radiation.

34. A question which immediately poses itself is whether military operations would be compatible with destruction of the scale indicated by estimates such as these. A vast civilian population would be involved unless the battle took place in desert conditions. The number of casualties, civilian and military, cannot be easily related, in any precise way, to the population actually in the area at the time of the battle. Because the need to reduce the level of military casualties would dictate tactics of dispersal, the number of nuclear strikes necessary to produce assumed military results would go up very rapidly. Fear and terror, both in the civil and military population, might overwhelm the situation.

35. Military planners have no past experience on which to call for any guide as to how military operations could proceed in circumstances such as these. When such levels of physical destruction are reached, one might well ask what would determine the course of a nuclear battle? Would it be the number of enemy casualties? Would it be the violent psychological reaction, fear and terror, to the horror of widespread instantaneous destruction? Would the chaos immediately bring all military operations to a halt? Whatever the answer to these questions, it is clear enough that the destruction and disruption which would result from so-called tactical nuclear war would hardly differ from the effects of strategic war in the area concerned. The concept of escalation from tactical to strategic nuclear war could have no possible meaning in an area within which field warfare was being waged with nuclear weapons.

36. This picture is not altered if one postulates so-called "clean" nuclear weapons, in place of those which formed the basis of the foregoing studies. Claims have been made about the possibilities of providing, for battlefield use, low yield weapons (say 1 to 10 kilotons) which would release an abnormally high proportion of their energy in blast and nuclear radiation, while producing virtually no radio-active fall-out. "Clean", in this context, is a matter of degree. These suggested weapons would basically rely on a fission reaction so that radio-active fall-out

could never be completely avoided.³ In any case, the foregoing studies postulated nuclear explosions which yielded minimal radio-active contamination from normal fission weapons. The resulting chaos in the battlefield area was brought about, not by fall-out, but primarily through blast effects. Thus, if "clean" weapons were available for battlefield use it is difficult to believe that similar chaos would not ultimately be produced. Sooner or later the battlefield situation must be expected to become similar to that which the foregoing studies have indicated.

Interdiction targets

37. Were such weapons ever to be used in a war, it is also quite certain that they would not be restricted to the battle zone itself—even if it were assumed that there would not be what is usually referred to as a strategic exchange. It is part of the concept of tactical nuclear warfare that in a purely military campaign they would also be used outside the area of contact in order to impede the movement of enemy forces, the operation of air forces and so on. The objectives which would be attacked in order to achieve these effects are generally called interdiction targets. Theoretical studies of operations of this kind provide a picture of "deep" nuclear strikes whose effects would be hardly distinguishable from a strategic nuclear exchange in which both sides set out from the start to destroy each other's major centres of population. To illustrate what is implied, reference can be made to a single strike in one such study in which it was assumed that the railway installations in a major transport centre were attacked by a single twenty-kiloton bomb, or a single 100-kiloton bomb, in order to make the centre impassable to troops and supplies, and thereby to assist the land battle elsewhere. The railway centre chosen for this study was a city with 70,000 inhabitants living in 23,000 houses in an area of some fifty sq. km. The bomb was assumed to be burst at ground level so as to maximize the effects on the railway lines. This mode of attack, unlike that used against the Japanese cities, would at the same time also maximize local fall-out damage. With the twenty-kiloton bomb, railway tracks would be demolished over a length of about 100 metres, a large amount of spoil from the crater would cover all lines in the vicinity, blockage would be caused by the collapse of road bridges, rail flyovers and buildings out to about a half-mile from the burst. All fuel depots and servicing sheds would be destroyed. With a 100-kiloton bomb the scale of damage would, of course, be greater; about one mile of track would be destroyed or blocked by heavy debris, and the main roads through the town would be completely blocked. The problem of reopening a road or railway would be hampered by a vast

³ The same would apply to larger so-called "clean" weapons used in a strategic role. In this case there would in addition be considerable induced radio-activity caused by the capture of neutrons in atmospheric nitrogen, thus producing very long-lived radio-active carbon-14. So far as long-range and long-term fall-out is concerned, this radio-active hazard from so-called "clean" weapons is comparable in importance to that from less "clean" weapons. (The foot-note to annex 1, para. 7, applies also to "clean" weapons.)

amount of radio-active debris. It would indeed be so great that it would almost certainly be easier to build a new by-pass round the town. If such attacks formed part of a general "interdiction" programme of bombing, it stands to reason that the transport communication system of a country could be totally wrecked in a very short time, and with it much more as well.

38. The estimated inescapable collateral effects of bombing a single railway centre in such a programme of attacks indicate that most of the industrial and commercial property in the middle of the town would have been destroyed. Fire would have consumed not only houses but also the larger buildings and factories not immediately destroyed by the explosion. A twenty-kiloton bomb in an "interdiction" attack on a town which was a communications centre—and few, if any communication centres are not towns—would kill about a quarter of the 70,000 inhabitants, while a 100-kiloton attack would kill about half. The survivors would have to contend with the same kind of situation as has been depicted in the case of the two Japanese cities bombed in 1945, or the larger city attacked by a one-megaton weapon which has been described above. A programme of "interdiction" attacks on targets behind the zone of contact of opposing armies, if such a programme included communication centres as well as airfields, supply depots, armament factories and so on, would be no different in its effects from those of a widespread so-called strategic nuclear exchange between two opposing Powers.

DETERRENCE OF WAR

39. Nuclear weapons constitute one of the dominant facts of modern world politics. They are at present deployed in thousands by the nuclear weapon Powers, with warheads ranging from kilotons to megatons. We have already witnessed the experimental explosion of a fifty to sixty-megaton bomb, i.e., of a weapon with about 3,000 times the power of the bomb used in 1945 against Japan. Hundred-megaton devices, weapons about 5,000 times the size of those used in 1945, are no more difficult to devise. They could be exploded just outside the atmosphere of any country, in order utterly to destroy hundreds, even thousands, of square kilometres by means of blast and spreading fire. It has been suggested on good authority that in certain geographical circumstances multi-megaton weapons could also be exploded in ships near coastlines in order to create enormous tidal waves which would engulf the coastal belt.

40. The effects of all-out nuclear war, regardless of where it started, could not be confined to the Powers engaged in that war. They themselves would have to suffer the immediate kind of destruction and the immediate and more enduring lethal fall-out whose effects have already been described. But neighbouring countries, and even countries in parts of the world remote from the actual conflict, could soon become exposed to the hazards of radio-active fall-out precipitated at great dis-