TOP SECRET

29

Copy No 1 of 21 copies

Page 1 of 2 pages

MINISTRY OF DEFENCE WHITEHALL LONDON SW1A 2HB

TELEPHONE 01-218 9000
DIRECT DIALLING 01-218 2111/3

TOP SECRET

MO 18/1/1

PRIME MINISTER

NUCLEAR WARHEAD PROGRAMME

We face major problems of resources, mainly skilled manpower, for nuclear warhead procurement which could affect our options for nuclear weapons systems.

2. The only capacity we have in this country for the whole process of producing nuclear warheads from basic research to the delivery of weapons to the Services, lies in the Atomic Weapons Research Establishment (AWRE) Aldermaston, and the Royal Ordnance Factories at Burghfield and Cardiff. Industry can take some of the development work of the associated systems, as it does with the Chevaline project, but has no capacity for warhead development and manufacture. There is, of course, no question of our being able to acquire nuclear warheads from abroad for unrestricted national use.

3. In 1961, when we were engaged on a major nuclear weapons programme, AWRE had about 8,800 people, but after the Polaris warhead went into service in the late 1960s AWRE's programme was reduced and numbers were allowed to fall to the present 4,500. Some of this fall has been the result of the difficulty of recruitment following the plutonium scare last year and the uncompetitive rates of pay to which pay policies have limited us. Following Sir Edward Pochin's report on the plutonium problems last year we are having to introduce new health and safety standards which require approximately 400 extra staff. About

/ 600 ...

TOP SECRET

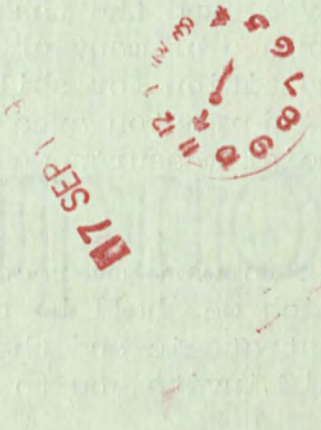
600 more are required to make good existing staff shortages to enable us to complete the Chevaline programme and to undertake one new project. A further 500 would be needed to enable us to run two projects in parallel. The most crucial shortages are of engineers, skilled craftsmen, draughtsmen and health physics personnel.

4. I am looking urgently at how the capacity of AWRE could be built up to enable us to complete Chevaline, to take on the development of a warhead for whatever Polaris successor we decide upon and to develop a national theatre nuclear capability. I have already secured the agreement of my colleagues to special pay incentives for a limited category of staff at Aldermaston, but it is too early to say what effect these will have. We shall most certainly need new incentives, and the task will be difficult, given the national shortage of many of the specialist skills we require, the competition for skilled people from private industry in the Aldermaston area and the repercussions elsewhere of special measures we take for Aldermaston's benefit.

5. I shall put forward my recommendations in time for the decisions which we shall be taking later this year on the options for strategic and theatre nuclear forces. At this stage I would invite you to note that the problem exists.

6. I am sending copies of this minute to the Home Secretary, the Foreign and Commonwealth Secretary and the Chancellor of the Exchequer, and to Sir John Hunt.

17th September 1979



SECRET COVERING TOP SECRET ATOMIC 10

MINISTRY OF DEFENCE
MAIN BUILDING WHITEHALL LONDON SW1
Telephone 01-~~XXXXXX~~ 218 2111/3

No.10 A.R.25.

SECRET
COVERING TOP SECRET
ATOMIC
UK EYES A

24th May 1979

MO 18/1/1

BGC .. put it away
MCKH
24/5

Dear Bryan.

NUCLEAR WARHEAD TEST PROGRAMME

I attach a background note by officials here on the nuclear warhead test programme which the Defence Secretary feels may be of interest to the Prime Minister and other Ministers involved in the Restricted Group on Nuclear Matters. Paragraphs 8 and 9 of the attachment refer to provisional plans for nuclear tests. These plans have yet to be considered by the Defence Secretary and no decisions are needed on them now. When decisions are required, the Defence Secretary will, of course, submit proposals to the Prime Minister in the normal way.

I am copying this letter and attachment to Sir Robert Armstrong (Home Office), George Walden (Foreign and Commonwealth Office) and to Martin Vile (Cabinet Office).

Yours sincerely,

Roger Facer

(R L L FACER)

B G Cartledge Esq.,
10 Downing Street

SECRET COVERING TOP
SECRET ATOMIC UK EYES A

SECRET COVERING TOP SECRET ATOMIC

TOP SECRET ATOMIC UK EYES A

PUS/79/A1
28/4

18/1/1

Copy No 1 of 9 Copies

S of S circulation - see Page 4 Copy No 1 of 4 copies of
Copy No 1 of 9 copies

THE NUCLEAR WARHEAD TEST PROGRAMME

Early History

1. Prior to the US/UK/USSR moratorium on nuclear tests in 1958 (which the USSR unilaterally broke without warning in 1961), the UK provided her own facilities for testing nuclear weapons. These facilities were established first for kiloton tests in Australia and later for megaton tests at Christmas Island in the Pacific. All the British tests and almost all the foreign tests carried out up to this time were staged in the atmosphere, in space or, exceptionally underwater.

2. Following the breakdown of the moratorium but before the conclusion of the Partial Test Ban Treaty (PTBT) in 1963, testing was resumed by the UK and US as well as by the Russians again generally above the earth's surface but with some shots being conducted underground. This latter environment became the only one available for use once the PTBT came into force and the UK decided to use the US Nuclear Test Site at Nevada rather than develop her own underground testing area. At that time, it was expected that the PTBT would not only eliminate the injection of radioactive debris into the atmosphere but also severely inhibit nuclear weapon development. Experience has proved otherwise and, for most purposes, the underground environment is now positively preferred for weapon testing. This is because it is possible to simulate nearly all the conditions which would be met above ground, including those in outer space, in an underground test and to do so in a controlled and reproducible fashion. The only drawbacks are that it is not possible to explore the interaction between a nuclear explosion and the real atmosphere and it is difficult to measure the effects of nuclear explosions on large scale military targets.

Level of Testing

3. Nuclear test explosions have been carried out by the US, the USSR, the UK, France, China and India and the current totals of tests for each country are:

United States (first test 1945):	773 of which 665* have been underground
Soviet Union (first test 1949):	491 of which 305* have been underground
United Kingdom (first test 1952):	31 of which 10 have been underground
France (first test 1960):	78 of which 33* have been underground
China (first test 1964):	25 of which 5* have been underground
India (first and only test 1974):	1 underground

*Not all of these have been announced

TOP SECRET ATOMIC UK EYES A

Almost all of these tests have been in the yield range from sub-kiloton to a few megatons. But the USSR and US have detonated some multi-megaton devices, the largest being about 100 megatons exploded by the Russians in 1961.

The UK Test Programme

4. The single most important event in the UK nuclear programme was the conclusion of the 1958 US/UK Defence Agreement. Prior to 1958, the US and UK weapons programmes had proceeded independently since World War II because the 1946 McMahon Act put an end to all US co-operation with other countries on nuclear weapon design. It is remarkable that, during these 12 years of entirely separate development, British and American weapon designers proceeded along almost identical paths and by 1958 had arrived at almost the same state of knowledge about the fundamental principles of weapon design. The Americans had, however, carried out much more engineering development than had been possible under the small British programme. With the signing of the Defence Agreement, the Americans were willing for the UK to take over some of their engineered designs so that there was then no need to continue immediately with the planned UK test programme.

5. The most notable early UK adoption was the US design of a warhead for a megaton free fall bomb for arming the V-Bomber Force, which at that time, provided the British nuclear deterrent. This US design was copied and put into Service without even a confirmatory UK test. Later, when it was decided to transfer the deterrent role to Polaris submarines, the UK adopted part of a US warhead design and developed the other part for herself for the UK Polaris warhead. The full US design was not adopted only because it incorporated engineering techniques which could not be duplicated in the UK in time to meet the required Polaris deployment dates. The hybrid US/UK warhead was successfully tested at Nevada in 1964 and 65 and put into Service thereafter. A measure of the value of the US/UK exchange is indicated by the fact that the Americans normally need between 10 and 20 tests to develop a new warhead whereas the UK Polaris warhead was completed after just two tests.

6. The UK carried out no nuclear tests between 1965 and 1974. But during this period, there was an increasing awareness that the Polaris warhead was very vulnerable indeed to anti-ballistic missile (ABM) defences.

* ~~~~~~~~ *

From 1961 to 1963, the Russians carried out a large number of high yield nuclear tests outside the sensible atmosphere and then and later it became clear that they were deploying an ABM system which was designed to intercept incoming missile re-entry bodies before they re-entered the atmosphere, i.e. an exo-atmospheric defence system. Putting these facts and others together, led to the realisation that the Polaris warhead was very vulnerable

* ~~~~~~~~ *

~ Passages deleted and retained under Section 3(4).
CWayland, 13/12/11

TOP SECRET ATOMIC UK EYES A

TOP SECRET ATOMIC UK EYES A

Passages deleted and retained under Section 3(4).
C A Wayland.
13/12/11

7. In the light of this appreciation, a research programme on hardening measures for reducing the exo-atmospheric vulnerability of Polaris was instituted at AWRE in the mid-1960s. This developed into the Polaris Improvement Programme, now known as Chevaline, comprising the hardening of the warheads and re-entry bodies and the inclusion of decoys [ ] to confuse the radars of the ABM system. In 1970, the US President approved full hearted US co-operation on the Polaris improvement and endorsed a series of tests in which UK components were exposed to the flux from the underground explosion of US nuclear devices in order to assist with the development of the hardening element of the programme. These underground flux tests are extremely complicated to mount. They would have been quite beyond the limited resources of the UK but they were vital to the UK programme. The US Presidential determination also authorised the conduct of UK underground device tests at Nevada and the first of these was conducted in 1974. Two further device tests were carried out in 1976 and 1977 and as a result the UK has now a proven hardened warhead for Chevaline, expected to enter Service in 1982.

8. For a successor to Chevaline, capable of defeating future ABM systems, it will be essential to adopt a warhead which is compatible with a high speed re-entry body rather than a low speed re-entry body as used in Chevaline. The information obtained from the Chevaline programme indicated how it should be possible to reduce the size and weight of the warhead without any appreciable loss of yield in order to achieve this aim. We know the Americans have been successful but the details of their designs have been withheld because the UK did not adopt Poseidon. With US approval, two nuclear tests were carried out at Nevada in 1978 and 1979 to test the validity of the ideas for a small, light, hard ballistic missile warhead; these were both successful. A further test on the same theme is planned for mid-August, 1979. The shaft for this test has already been drilled and the test device has already been delivered to the United States. If this too were successful, it would then be possible to produce a hard, lightweight UK warhead of [ ] suitable for a submarine launched ballistic missile (SLBM) carrying Multiple Independently-targetted Re-entry Vehicles (MIRV).

9. The above situation reflects great credit on the UK weapon designers who have progressed so far on the basis of only two or three tests. But, from discussions with the Americans, it is obvious that there is scope for even further improvements.

An experimental UK device which might almost match the current US performance has been designed and there are provisional plans to test this at Nevada in mid-1980. A successful test would enable the UK to produce a [ ] warhead for an SLBM with [ ] MIRVs.

TOP SECRET ATOMIC UK EYES A

TOP SECRET ATOMIC UK EYES A

~ Words deleted and retained under S.3(4) CWayland, 13/12/11

Underground Testing Technology

10. Even the most straight-forward underground nuclear test is a complex operation requiring many months of preparation. The simpler tests are those aimed at investigating the performance of a device design. A *~* device has to be emplaced at the bottom of a shaft some 1800 feet deep and 8 feet in diameter. The shaft takes months to drill and may have to be lined over part of its length to prevent wall collapse or water ingress. The explosive device with all the diagnostic instrumentation has to be engineered into canisters to give a rigid assembly suitable for lowering into the shaft and the instrumentation has to be cabled back to the surface control and recording facility. Once the canisters have been emplaced, the shaft has to be filled with concrete to prevent any debris from the explosion venting back into the atmosphere. In all, the operation takes about 9 months from the start of the firing date. A vitally important part of the operation is a detailed assessment of the device design and its emplacement situation to give assurances that the test will not contravene the provisions of either the PTBT or the US/USSR Threshold Test Ban.

11. This description indicates that the UK needs to allow about 12 months between seeking US approval for a UK test and the desired firing date. The Americans, who are exceedingly generous in providing facilities, have to consider how a UK test can be accommodated without prejudice to their own very much larger test programme.

Comprehensive Test Ban Treaty

12. It appears highly unlikely that the Comprehensive Test Ban (CTB) Treaty now under negotiation between the US, UK and USSR could come into operation before mid-1980 and hence the immediate UK test plans are not threatened. But, if and when a Treaty does enter into force, it would put a stop to weapon development for the foreseeable future. There is accordingly an urgency to press ahead with as much development through nuclear testing as is possible.

American Co-operation

13. The foregoing indicates the crucial importance to the UK's nuclear programme of the assistance given by the US. The Americans are, however, prohibited by their 1954 Atomic Energy Act from exporting nuclear warheads to other countries, except where they remain under US custodial control. Clearly such an arrangement would be inappropriate for the UK's independent strategic deterrent. If it were decided to buy a US strategic system to succeed Chevaline, the US would most probably supply the full design details of their warhead for this system. It is, however, unlikely that the UK could produce exact copies of this warhead on an adequate timescale because of the lack of the appropriate production methods in the UK. Consequently the most probable option would be to adopt a UK designed warhead.

Ministry of Defence
17 May 1979

MOD Reproduction Series 'A'
S of S circulation 24.5.79
Sir Robert Armstrong (Home Office)
G G H Walden, Foreign & Commonwealth Office
Martin Vile, Cabinet Office
B G Cartledge, 10 Downing Street