

Lightweight warhead development at Aldermaston 1976 - 1980

Between April 1978 and April 1980 the UK carried out [a series of] four tests [or possibly more] at the Nevada test site to develop a lightweight warhead.

There had been two earlier tests in 1974 and 1976. The warheads detonated in these [deleted] tests were intended for [a successor to] the Chevaline system. The test on 23 May 1974 was of the UK-designed Harriet primary. This primary was hardened against the effects of X-ray radiation from Anti Ballistic Missiles. Harriet was combined with a secondary, Reggie, derived from the US W59 warhead, [used in the original A3T Polaris UK warhead, and refurbished for Chevaline.]

In 1976 AWRE were asked to reduce the weight of the warhead for Chevaline. [WHO BY? Is there any hard evidence?] They developed a new or modified warhead which would be lighter than the Harriet/Reggie design. Assistance was given from the United States -

"Long discussions on the technical issues of the lightweight warhead proposal were held in the United States in January 1977 with representatives from both American nuclear weapon laboratories."¹

One of these laboratories, Lawrence Livermore, had developed the W68 warhead for Poseidon. The other, Los Alamos, designed the higher-yield W76 warhead for Trident. The first W68 was completed in May 1970 and first W76 was produced in June 1978. W68 weighed 367 lbs and W76 363 lbs.

The Americans were prepared to help Aldermaston because they were keen to find out more about "a new and innovative warhead design for a possible Chevaline replacement which deliberately excluded as much American design experience as possible".²

The US laboratories felt that the Aldermaston design was feasible but that "measures being taken in the design had increased the risk of it not working at all"³

The first test of the lightweight design was the Fondutta test on 11 April 1978. Chevaline Progress reports in July 1978 and January 1979 show that the Fondutta design was being considered as an option for Chevaline and that the test was a success.⁴

The second test of the lightweight warhead was the Quargel test on 18 November 1978. Two weeks before this test the Defence Minister sent a memorandum to the Prime Minister -

"This proposed test device is of exceptional technical importance in maintaining all our options for future deterrent systems ... The proposed test is intended to explore the technology of very small triggers in a new area. It will only be the second test that we have carried out that is relevant to small hard warheads".⁵

¹ AWRE contribution to the Chevaline payload, Kate Pyne, October 2004

² ibid

³ ibid

⁴ DEFE 25 - 335 E45 National Archives Chevaline Progress Report July 1978 & DEFE 25 - 335 E45 National Archives Chevaline Progress Report January 1979

⁵ DEFE 25 - 335 E29 National Archives. Memo from Secretary of State for Defence to Prime Minister 3 November 1978.

Shortly after the test Vic Macklen, the Director of AWRE, wrote that the yield of the Quargel test was 47 kilotons, close to the predicted yield of 52 kilotons.⁶ The results of the test were "comparable with the results from the Poseidon design".⁷ The W68 Poseidon warhead had a yield of a 40 – 50 kilotons. The comparison with W68 suggests that the Quargel test was of a complete device, not just the primary of a larger warhead. [I AGREE. This has always struck me as odd. Brian.] It also appears that a crucial part of the new design was that it incorporated a "very small" trigger or primary.

Vic Macklen described Quargel as the first test that would allow a high-speed RV for a ballistic missile. The earlier Harriet/Reggie design was too large for a high-speed RV and it could only fit inside a slower blunt RV.

He also wrote that a further test would be needed in 1979 and that this additional test could unlock design information from the US -

"If this test were successful it would open the door to far more exchange with the Americans on their devices of a similar nature".⁸

Before this further test was carried out, the MoD had decided that the lightweight warhead would not enter service in 1983 as had been proposed.⁹ The idea had been that when Chevaline was introduced the first two submarines would have been armed with Harriet/Reggie and then the third submarine would have been armed, in 1983, with the lightweight warhead. However by January 1979 it had been decided that the slight increase in range from the new warhead did not justify the additional cost or the disruption it would cause to the main programme. So the new design was not adopted for Chevaline.

In January 1979 Jimmy Carter told Jim Callaghan that a UK request for Trident would be looked upon favourably. In May 1979 Margaret Thatcher became Prime Minister.

The planned third test of a lightweight warhead took place in the Nessel test on 29 August 1979. The device was called Dichel. Two months before it took place Vic Macklen wrote to the Defence Minister -

"The test is of particular importance to the UK in advancing the design of small, hard warheads suitable for deterrent successor systems .. If this test is successful we should be well on the way to proving a British warhead design for a successor system, but CTBT permitting, we would need to be able to plan for at least two or three more tests to ensure that a successor warhead would have sufficient yield, to demonstrate a design for future tactical nuclear warheads, and a spare slot to insure against a test failure".¹⁰

The next UK test was Colwick on 26 April 1980. The device, Dingbat, was expected to have a yield in the same bracket as Dichel and other recent tests.¹¹ It is likely that the four tests, Fondutta, Quargel, Nessel (Dichel) and Colwick (Dingbat) all had yields in the region of 50 kilotons and were all for the development of a lightweight warhead with a very small primary [that would serve as a single common design suitable for several delivery systems, in the way that Cleo /Super Octopus/Katie

⁶ DEFE 25 – 335 E37 National Archives

⁷ ibid

⁸ ibid

⁹ DEFE 25 – 335 E45 National Archives Chevaline Progress Report January 1979

¹⁰ DEFE 19 – 181 16/27 National Archives Letter from Vic Macklen to Secretary of State for Defence 17 June 1979

¹¹ DEFE 19 – 181 51/3/79 National Archives

lineage had done earlier for Skybolt, Blue Water, Polaris A3T, and all versions of WE.177.] [Provides a link to TASM and TD.127 and is supported by your ref note 10.]

The 50-kiloton lightweight warhead could have provided an alternative to Harriet/Reggie for the Chevaline system, but it was not ready in time and it did not provide enough of a range advantage over the earlier design. The yield may also have been too low. The US Navy Poseidon system was derided by the US Air Force as a "firecracker". Its 40-50 kiloton warheads were only effective against cities and a limited variety of military targets.

On 14 July 1980 Jimmy Carter wrote to Margaret Thatcher agreeing to supply the Trident missile system. At this time the UK were seeking to develop two nuclear warheads – one for the Mk4 Trident RV and one for a future RAF weapon. The low yield of the lightweight design was one problem. Before it could be deployed on a submarine system AWRE would have to demonstrate that a higher yield, probably equivalent to the W76 (100 kiloton), could be achieved.

Following Colwick two further tests were carried out in 1980, the low-yield Dutchess test on 24 October and the Serpa test on 17 December. One report suggests that one or both of these could have been for Chevaline.¹² If so they might have been production tests of the Harriet/Reggie warhead. The Dutchess test was carried out with support from Los Alamos, while several other tests around this time were supported by Lawrence Livermore Laboratory.¹³

In 1982 the development of the warhead for Trident was described as being well advanced.¹⁴ 8 UK nuclear tests were carried from November 1981 until July 1987. The bulk of these were for Trident.¹⁵ The design of the UK Trident warhead was frozen in 1987.¹⁶ The first plutonium pit for the new warhead was manufactured in 1988.

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There are a number of indications that the UK Trident warhead was based on the US W76 design:

- The National Archives guide to archiving nuclear weapons information says of Trident - "The warheads were anglicised by the AWE"¹⁷. The term *anglicised* [means] that AWE [adapted] a US design [to British low-scale manufacturing methods and differing safety standards]. [A long-running saga with AWE and safety regulators. Brian.]... [See additional ref 21]
- In 1995 Harold Agnew, former Director of Los Alamos National Laboratory, said in a BBC interview that the British Trident warhead was a "Dutch copy" of the US warhead.¹⁸ [British Civil Servants had used the term 'Chinese copy' when referring to the original Polaris warhead proposal, and it had been rejected by the UK for the same reasons, - that the PBX-9404 HE used was too shock-sensitive to meet UK safety standards. Ironically, altho' the UK rejected it for that reason, down the river at the Holy Loch, the USN Polaris subs based there used the 'unsafe' HE in their warheads. Refs to this appear in the PRO.]

¹² DEFE 25-335 E93 National Archives

¹³ *ibid*

¹⁴ House of Commons Defence Committee HC 266 1981/82

¹⁵ Progress of the Trident Programme, House of Commons Defence Committee HC 374 1988

¹⁶ *ibid*

¹⁷ Operations Selection Policy OSP11, Nuclear Weapons Policy 1967 – 1998, National Archives, November 1005.

¹⁸ Moscow Criterion, BBC, July 1995.

- The British Trident warhead uses the same Neutron Generators as the US W76.¹⁹

However the British warhead is not identical to the US warhead. It uses a British explosive, EDC 37, rather than the US explosive, PBX9501. [Because of the safety standards referred to above]

The UK Trident warhead is probably not derived from the lightweight warhead tested in 1976-1980. However the development of this warhead will have opened up access to information on the US W76 design. [I'd like to see a link made here to all the unnecessary nuclear tests done at NTS just to get to acquire what was no more than a political bargaining chip, with no likelihood that this warhead would ever be manufactured or deployed. A bloody disgrace.]

A number of nuclear tests were carried out for a new RAF warhead, for TASM/TD 127. The requirement for at least one such test was identified in June 1979.²⁰ However it is not yet possible to trace the development of this design. [But it almost certainly stems from the basic design tested at Fondutta, Quargel, Nessel etc identified in declassified papers as also for a tactical weapon. Unless the US supplied yet another design.] ... [And where did the (alleged) UK Trident D5 sub-strategic warhead come from?]

¹⁹ Future of the British Bomb, Scottish CND, 2006.

²⁰ DEFE 19 – 181 16/27 National Archives Letter from Vic Macklen to Secretary of State for Defence 17 June 1979

21. Lorna Arnold. The official MoD history. Britain and the H-Bomb. Palgrave 2001. ©MoD. ISBN 0-333-94742 paperback. Page 214-5. Scanned copy at attachment.