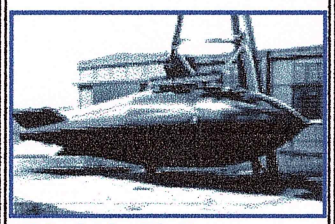
Britain's Nuclear Weapons

History of the British Nuclear Arsenal

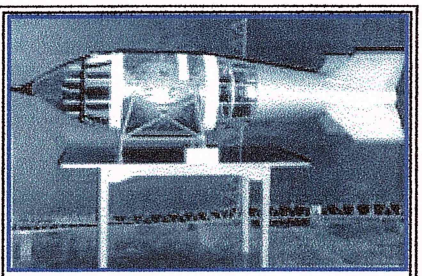
Last changed 30 April 2002

Blue Danube (Mark 1)



500x323, 20 K

Blue Danube



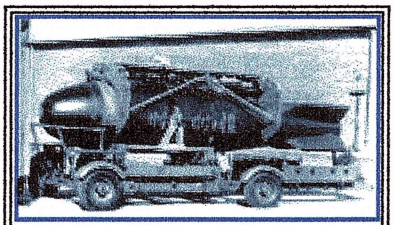
640x406, 35 K

Blue Danube
Cutaway Display

This free fall bomb was the first nuclear weapon stockpiled by Britain, going into service in November 1953. It was a pure fission bomb initially using plutonium, but later modified to use a composite plutonium/U-235 core. Tests were also conducted with a uranium only core. It had a nominal yield of 15 kt. Based on Hurricane, the first UK tested device, it was essentially a lab-built, limited production weapon. From a technology standpoint it was probably very similar to the U.S. Mk 4, which went into service in 1949. Like the Mk 4 it had a 60 inch, 32 lens implosion system and used a levitated core suspended within a hollow uranium tamper. The 5 ft diameter explosive sphere was in a 24 ft long weapon case. This case was almost twice as long as that used by the U.S. in its large diameter fission bombs (10 ft 8 in), which made for a bulkier but more aerodynamically stable weapon.

It was continuously modified, so it existed in a number of "variants", some with yields up to at least 40 kt. It was tested in Buffalo Round 2 (4 October 1956) and 3 (11 October 1956) with low yield cores providing yields of 1.5 and 3 kt. Only about 20 were manufactured by early 1958 when production terminated. It remained in service until 1962.

Red Beard



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Red Beard

Red Beard was a second generation fission weapon. It was a relatively light weight tactical fission bomb using a tritium boosted plutonium/U-235 composite core. Development began in 1954 and was substantially complete by 1958. Production in significant numbers began in 1959, but it was not operationally deployed until 1961. Red Beard was about 3 feet in diameter, 12 feet long, and weighed 2000 lb. These weights and diameters make it roughly the equivalent of the U.S. Mk-5 or Mk-7 bombs, both of which went into service in 1952 (although these weapons were not boosted). The smaller size made it possible for tactical aircraft to carry it as well as strategic bombers.

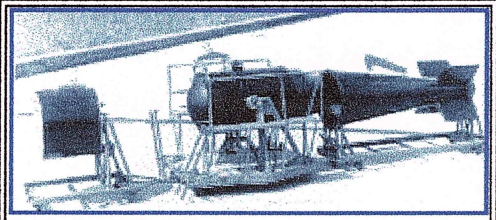
It was tested in Buffalo Rounds 1 (27 September 1956) and 4 (22 October 1956) with yields of 15 and 10 kt respectively. A variable yield of 5-20 kt has been claimed for this weapon. This device was adapted as the primary for the first British thermonuclear weapons, tested in 1957. Red Beard was in service from 1961 to 1971. A maximum of 80 bombs was in RAF inventory, and about 30 in the Fleet Air Arm stockpile, during the early 1960s.

Violet Club

This interim air dropped bomb had an estimated yield of 500 kt. The case was very similar to the Mark 1, its weight was 9000 lb. Deployed in early 1958, only five were planned for deployment. The deployed bombs were subsequently converted to Yellow Sun Mk 1 bombs.

The device used in Violet Club was called Green Grass. This device had not been previously tested, and was based on a **design** prepared for Grapple (but also apparently not tested), although its yield was predicted from devices that were tested in Grapple. Based on this, and the similarity in names, it may be surmised that Green Grass is based on Green Bamboo (bamboo is a type of grass after all). The probable alteration was to reduce the fissile content (to perhaps 75 kg or so) thus making better use of Britain's scant U-235 stockpile. The severe safety problems of this **design** clearly indicate a high fissile content. The intent would have been to provide a high yield weapon that could be quickly deployed in reasonable numbers (impossible for Orange Herald).

Yellow Sun Mk 1



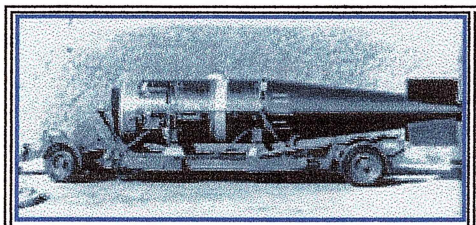
640x271, 30 K

Yellow Sun Mk 1

This was Britain's first deployed "true" H-bomb. Violet Club incorporated fusion fuel but represented an awkward, expensive, inefficient, dead-end **design**. Yellow Sun Mk 1 employed the radiation implosion technology demonstrated during Grapple in 1957. This was a megaton range weapon that entered service in 1958. Since the first such **design** had been successfully tested only in November 1957, it may be assumed that these weapons were akin to the U.S. "emergency capability" thermonuclear weapons deployed in 1954. That is, they were thermonuclear systems that would work, and could be delivered, but cut a lot of corners in engineering and military requirements areas like safety, reliability, cost, stockpile life, flexibility, efficiency, etc. The high yield tests of April and September of 1958 may have been in part refinements of this **design**.

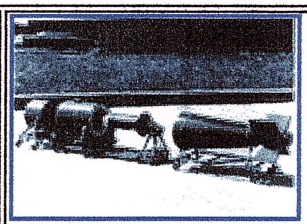
The Yellow Sun Mk 1 warhead was about 4 feet wide and 9 feet long, the whole weapon was 21 feet long. Probably only a few were deployed. The decision to adopt the advanced American Mk-28 thermonuclear weapon design, made in September 1958, brought Yellow Sun Mk 1 manufacture and development to a halt.

Yellow Sun Mk 2/Red Snow



640x288, 29 K

Yellow Sun Mk 2



400x282, 30 K

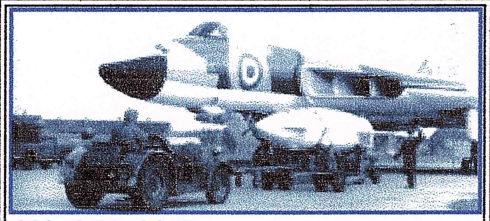
Yellow Sun Mk 2 disassembled

It is believed that this weapon was the British manufactured version of the Mk-28 1 megaton warhead. The first of these was completed in April 1961. The weapon seems to have been the same size as the Yellow Sun Mk 1, even though the Mk-28 is a much smaller weapon. Presumably the Mk-28 warhead itself is what is referred to as "Red Snow", but it

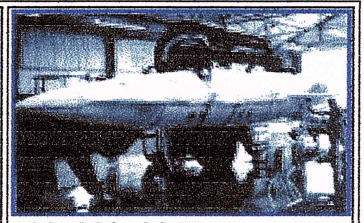
was deployed in the Yellow Sun weapons case. This may seem inefficient to use a large heavy case for a small weapon, but in fact it probably minimized force integration effort and cost. Aircraft, trained crews, and handling facilities were all already available to carry the larger weapon after all. It may also have been desirable to conceal the radical reduction in warhead size.

The Yellow Sun Mk 2/Red Snow entered service in 1961. During their initial deployment, they displaced the similar sized Blue Danubes then in service. The Mk 2s remained in service until 1972, when they were phased out by the WE-177. A maximum of 150 were built.

Blue Steel


640x274, 23 K

Blue Steel

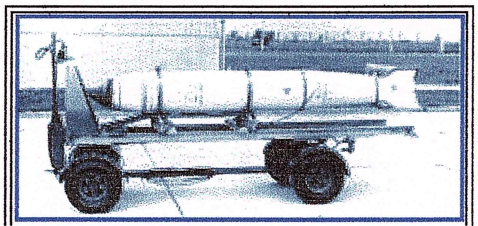

500x302, 28 K

Blue Steel close-up.

This was Britain's first nuclear missile. The Blue Steel was a liquid fuel air-to-surface strategic missile, carried by the British strategic "V-bombers" - the Vulcan B.2A and Victor B.2R. The missile began development in 1956, and entered service December 1962 with full operational status being achieved during 1963. The last Blue Steel was w1thdrawn from Victor squadron service at the end of 1968, and from Vulcan service at the end of 1970. Originally a large 200 kt fission warhead was planned, but this was later changed to a thermonuclear warhead with a yield of 1 megaton or more. This warhead was most likely an adapted Mk-28. About 57 of the missiles were ordered, and about 40 were deployed

The Blue Steel was 10.7 m long, had a wing span of 4.0 m, and weighed 6800 kg. It traveled at up to Mach 2.5, with a maximum range of approximately 200 km. The missile used in inertial navigation system that provided an accuracy of 100-700 yards (CEP).

WE 177


640x289, 32 K

WE 177 bomb

The WE 177 free-fall bomb was Britain's last air-delivered nuclear weapon. With its retirement in March 1998, the UK no longer had any aircraft carried nuclear capability. This bomb was produced in three versions - the relatively high yield strategic A and B versions (200-400 kt), and the lower yield tactical C version (approx. 10 kt). The A and B versions entered service with the RAF in 1966, the C version was deployed by the Royal Navy in 1971 as a strike/depth bomb. The retirement of the C version was announced in June 1992. The origin of the WE 177 is not clear. It is believed to be based on American designs, most likely the B-61 if it is indeed a single basic design. It has been suggested that the C version may be a different design from the A and B versions, in which case the B-57 is a plausible candidate for this version. U.S. documents indicate that in 1961 Britain had plans to produce B-57 variants.

The WE 177A weighed 272 kg (600 lb) and had a maximum yield of 200 kt, the WE 177B weighed 431 kg (950 lb) and had a maximum yield of 400 kt. Both weapons were variable yield designs. Although they were both one-point safe, they lacked insensitive high explosive or fire-resistant pits. Both variant were parachute retarded for low level delivery and could be used in laydown mode (time delayed detonation on the ground).

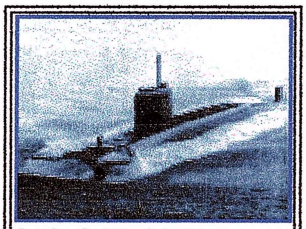
Quantity production of the WE 177 was delayed until the 1970s due to the production demands of the Polaris warhead which ended in 1969. Deployment was completed by the late 70s. The WE 177

was retired from service in March 1998, and dismantling was completed by the end of August 1998.

Polaris Warhead

There is some confusion about whether there were really two Polaris warheads (that is, "physics packages") or only one. The initial deployment of the three warhead A3T Polaris SLBM was accompanied by the production and deployment of a British-produced warhead, apparently a version of the American W-58 200 kt warhead deployed on the U.S. Polaris A3. Later an update of the Polaris missile force, known as the Chevaline program, was carried out with the modified missiles being re-designated the A3TK. This update included a new bus (upper stage), new RVs, and a sophisticated penetration aid (decoy) package. It is not completely clear whether the existing Polaris warheads were simply repackaged, or whether a completely new model was introduced. Due to Britain's limited weapons development and production capacity it seems likely that the warheads used to equip Chevaline, were based on the preexisting Polaris warheads.

Immediately after the 10 June 1963 decision by the British Admiralty to acquire the next-generation A3T Polaris SLBM (in preference to the A2 version then deployed by the U.S., Aldermaston began full-scale developmental work on the Polaris warhead. The design is said to be completed in the spring of 1966, with production beginning in 1966 or 1967. The "developmental" and "design" work associated with this warhead presumably involved adapting the already proof-tested American W-58 warhead to manufacture in a British plant. The warheads were deployed in Mk-2 RVs purchased from the U.S.


352x261, 20 K

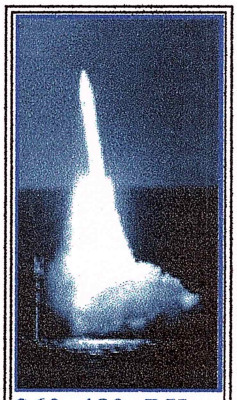
HMS *Resolution*

The Polaris A3 was the first multiple warhead missile, equipped with three MRVs (multiple re-entry vehicles). The MRVs were dispersed around a central aiming point, they were not independently targeted. Four Polaris subs of the *Resolution* class were deployed, each with 16 missiles. It is believed that only 144 warheads (plus possibly some spares) were manufactured, enough to equip three subs at a time. The fourth boat was in port for maintenance and refitting at any given time.

Two mid-life update programs were instituted for the Polaris missile.

The first and best known was the Chevaline (aka "Super Antelope" and "KH793") program. It began in secret (as is true of all British nuclear programs) in the late sixties when the Soviet Union began deploying an ABM system around Moscow. Although this system eventually turned out to be very limited in scope, concern about the continuing potency of the British deterrent developed and proposals were made to develop a countermeasure system to improve the ability for Polaris to penetrate these defenses. The program was not an original British undertaking, but was based on a classified U.S. program called Antelope which had made available to the UK in 1967. In June 1967, the Labour Government announced in Parliament its decision not to upgrade the Polaris system by purchasing Poseidon missiles from the United States. Instead of deploying Poseidon, it was decided to re-direct work at Aldermaston to investigate the possibilities of designing a new warhead capable of penetrating Soviet defences using decoys, hardening techniques and penetration aids. Studies of the concept were made in 1967 and the decision to proceed was made by the first Wilson government that same year. By 1969 the Chevaline concept was defined and by 1972 the system had been worked out in detail. It was approved for deployment by the Heath government (1970-74), a decision finally ratified by the second Wilson government in February 1974. At the time of the Wilson decision to proceed the cost was estimated at £250 million. By 1975 this cost had increased to £400 million, and a review was held to determine whether the program should be cancelled in September. This was an important moment in British nuclear policy making because the key issue on review was more than just Chevaline - it was whether the British could afford to maintain its deterrent and competitive in the arena of nuclear arms.

The existence of Chevaline was first disclosed on 24 January 1980 during a debate in Parliament by Conservative Defence Secretary Francis Pym. The total cost of the project was given as £1,000 million making Chevaline the most expensive defence project not to be made public. The high cost resulted in a highly critical report by the Public Accounts Committee published in 1982.

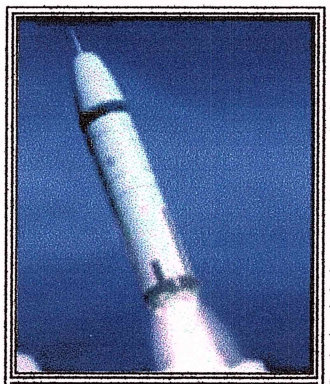

260x480, 7 K
Chevaline

Chevaline was a complex system was based on the coordination of the 16 missiles on a single submarine, maneuver by the RVs to elude interceptors, along with multiple decoy re-entry vehicles, and hardening of the warhead against ABM weapon effects. Each missile would fly a different trajectory so that all missiles would arrive simultaneously over the target (Moscow) and release two real warheads (reduced from the three of the AT3) plus four decoy RVs, and a large number of decoy balloons. The defense would be presented with 96 simultaneous maneuvering targets to intercept (even after the balloon decoys burned up). The system proved far more difficult to develop and deploy than expected.

The first Chevaline warhead was tested 23 May 1974 (possibly designated the TK-100). Sea trials of Chevaline were conducted in November 1980. Production of the Chevaline warhead ran from 1979-1982 with 100 warheads being produced. Chevaline went on patrol for the first time in mid-1982 aboard HMS *Renown*, with deployment completed in 1987. The estimated yield of the Chevaline is 225 kt.

In 1999 the decommissioning of the Chevaline system (presumably meaning warhead disasembly) was expected to be completed at the AWE during 2000.

The second update program for Polaris involved remanufacture of the solid fuel motors. This program began in 1981, and led to the installation of new motors in all missiles during 1986-87.


Trident Missile

Trident Warhead

After the completion of production for Chevaline, a total of nine nuclear tests were conducted by the UK at the Nevada Test Site in the U.S. Most or all of these were no doubt connected with the development of the Trident warhead. The first of these, Phalanx Armada (22 April 1983) had a yield of < 20 kt and was probably a test of the warhead primary, the next seven had yields between 20 and 150 kt and could have been tests involving the thermonuclear secondary. The last two of these high yield tests - Aqueduct Barnwell (8 Dec. 1989) and Sculpin Houston (14 Nov. 1990) were almost certainly full yield Trident tests, with seismic magnitudes of 5.7. The last nuclear test conducted by Britain was the Julin Bristol shot held on 26 November 1991. This test, with a yield of <20 kt, may also have been a final proof test of aspects of the Trident warhead such as one of the low yield options.

The first batch of British Trident warheads were completed in September 1992. They were designed by the Atomic Weapons Establishment (AWE) at Aldermaston, and are assembled at Aldermaston and Burghfield. The warheads are though to have similar characteristics to the U.S. W-76 now on U.S. Trident I and II missiles. Production of this warhead continued into 1999 which was probably its last year of production.

According to the AWE the Government's Chief Scientist has "recommended that the Trident design should be reviewed every seven years, to ensure it had not 'drifted' from its original intent."

The British Trident warheads are capable of selective yield, ranging from under a kiloton up to the full yield of 100 kt or so (this differs from U.S. SLBM warheads). Yields are probably 0.3 kt, 5-10 kt and 100 kt.