



# UK Nuclear History Working Paper

Number: 1

## **The Real Meaning of the Words: a Pedantic Glossary of British Nuclear Weapons**

**Richard Moore**

# The real meaning of the words: a pedantic glossary of British nuclear weapons

## Introduction

This glossary is intended as an aid for researchers, presenting the most accurate definitions available of British nuclear weapons codenames and nicknames. It is carefully based on public-domain information (only), in particular documents in the UK National Archives (formerly PRO) at Kew. It has been discussed by the Southampton University seminar group on British nuclear weapons history and incorporates comments, for which I am extremely grateful, from group members and from Brian Burnell. **Copyright** remains with Richard Moore but researchers are welcome to quote from the glossary with suitable acknowledgement.

Several types of codenames have been used for British nuclear weapons. The well known 'rainbow' names of the form (colour + noun) were assigned to weapons and equipment projects, nuclear and non-nuclear, by the Ministry of Supply (MoS). The names must have been random in theory, but an element of choice is apparent in their allocation (see e.g., Violet Mist for an example where more than one choice of codename was available). Some rainbow names were unofficial coinages: a non-nuclear example was Blue Yeoman, a radar incorporating elements of the earlier Blue Riband and Orange Yeoman projects. Some were haphazard word pairs (e.g., Indigo Hammer) but others more obviously matched (e.g., Blue Danube, Red Duster) and in one or two cases (e.g., Yellow Sun for a bomb based on thermonuclear fusion) coincidence in allocation seems unlikely. This system was replaced in 1959 in the new Ministry of Aviation (MoA) with a more anodyne digraph/trinome system (letter/letter/number/number/number). The Admiralty and Ministry of Defence (MoD) also allocated codenames according to their own systems, and the Atomic Weapons Research Establishment (AWRE) at Aldermaston often used its own nicknames for warheads and warhead-related items; weapon designers were able to exercise their own discretion (and occasionally wit) in this regard, and some relationships between designs are apparent as a result (see e.g., Granite-type). AWRE often used personal names as warhead nicknames.

The glossary is currently fuller for the period up to 1973 for which declassified documents are available.

Version control		
0.1	June 2003	First draft
0.2	Sept 2003	Revised after comments

1.0	Dec 2003	Revised for publication after further comments
1.1	Mar 2004	Final revision for publication
2.0	Mar 2004	Revised for MCIS website after further research and comments

**Antelope:** an American **Polaris** improvement study, combining elements of previous ideas/projects known as Exo-PAC, Mark-up, HEXO and **Topsy**. Included screening for electronics, a hardened 'sock' for the missile re-entry body and replacement of one warhead with a decoy system. Missile with Antelope was referred to as Polaris A-3A. Trialled during 1966-68 but did not enter service. UK Super Antelope was its conceptual successor. (American codename).

**Antler:** test series at Maralinga in Sep-Oct 1957. Originally known as Sapphire, then Volcano. (Official MoD operation codename?).

**Artificer:** security codeword covering information on Polaris improvement (see **Chevaline**).

**Atomic:** security codeword covering nuclear weapons information.

**Bloodhound:** surface-to-air guided weapon produced by Bristol Aircraft and Ferranti, originally against a War Office requirement, later against a number of Air Ministry requirements for the RAF. MoS codename was Red Duster. Suggestion of a nuclear warhead was made as early as 1955; **Indigo Hammer** and **Pixie** were both considered. Decision taken in 1958 that only a new command-guidance version of Bloodhound, to meet Air Ministry requirement OR.1166, would have a nuclear warhead. The warhead requirement OR.1167, also of 1958, would have been met by Indigo Hammer or later **Tony** (in **RO106**). The nuclear command-guidance weapon was cancelled in 1961 but conventional versions of Bloodhound saw many years' service with the RAF. (Manufacturer's trade name).

**Blue Boar:** TV-guided bomb designed by Vickers-Armstrong to meet Air Ministry requirement OR.1059 of 1947 (later OR.1089 of 1949). There were suggestions that a nuclear warhead, presumably either the **Blue Danube** or **Red Beard** warhead, would be required. The weapon was cancelled in 1954. (Official MoS 'rainbow' codename).

**Blue Bunny:** see **Blue Peacock**.

**Blue Cat:** warhead relating to US Mk.44, mentioned in one or two documents from the end of 1958. May have been an earlier name for **Tony**. (Official MoS 'rainbow' codename?).

**Blue Danube:** the first in-service British atomic bomb, produced in response to Air Ministry requirement OR.1001, issued Aug 1946 (2nd issue Aug 1948; 3rd issue by 1955). Used an all-plutonium implosion warhead similar but not identical to that tested in 1952 in the Montebello Islands. Weight around 10,000lb, length around 290in, diameter 62in. 10kt yield agreed by Chiefs February 1953 to conserve fissile material stocks; greater yield was required and consideration given to a mixed and boosted version of 30kt or higher, but the eventual service version had nominal 16kt yield. Delivered to the RAF beginning in November 1953; in-service capability from July 1955 but only given CA approval in 1957. Existed in two versions: Blue Danube Mk.1 with ground loading of the fissile core, and Blue Danube Mk.2 with in-flight loading; there were various other detailed differences and mods between weapons. A final deliverable stockpile of 58 had been built up by 1958 and was withdrawn in 1960-1; fissile material from the weapons was

reused in **Red Beard** bombs. Originally known simply as 'Mk.1' until other weapons requirements emerged; also referred to (in service) as 'Bomb, HE, 10,000lb, MC' or 'Smallboy,' probably by facetious association with its size. The name Blue Danube was at times (loosely) used to refer to the warhead or the casing. There were plans to use the same warhead in **Cudgel**, **Blue Peacock** and probably **Blue Boar**; Blue Danube casings were used to air-drop various test devices, and for **Violet Club**. (Official MoS 'rainbow' codename, first seen Feb 1955).

**Blue Envoy**: long-range surface-to-air guided weapon for the RAF, also referred to as Stage 1<sup>3</sup>/<sub>4</sub>. Nuclear warhead suggested in Air Ministry requirement OR.1140, drafted as early as Jun 1955 and issued in Apr 1956. Naval use was also suggested. The missile was cancelled in 1957. (Official MoS 'rainbow' codename).

**Blue Fox**: see **Indigo Hammer**.

**Blue Granite**: see **Granite-type**.

**Blue Peacock**: atomic landmine designed in response to a 1954 War Office requirement. Same warhead as **Blue Danube**; later suggestions that the **Red Beard** warhead should be used resulted instead in a separate project, **Violet Mist**. Requirement cancelled Dec 1957 in favour of Violet Mist, partly because the 7½-ton lorry carrying the weapon would have had too high a centre of gravity to drive off-road, but two prototypes (minus fissile material) were completed for training and one survives in the AWE Historical Collection. Originally known (unofficially) as Brown Bunny, renamed Blue Bunny in October 1954 then, when that codename was compromised, finally renamed Blue Peacock. Also unofficially nicknamed 'Big Bertha.' (Official MoS 'rainbow' codename, allocated May 1957).

**Blue Rosette**: 'short case' megaton bomb for the projected Avro 730 supersonic bomber. Air Ministry requirement was OR.1144 of March 1956. Intended originally to use the **Green Bamboo** warhead, weigh 6000-7000lb and measure 10-12ft long x 50in diameter; **Orange Herald** was also later suggested to reduce overall size and weight. Aircraft was cancelled in 1957 and bomb in April 1957. (Official MoS 'rainbow' codename).

**Blue Slug**: projected ship-to-ship guided weapon to meet Admiralty requirement of c.1953. Nuclear warhead, needing to be smaller than **Red Beard**, suggested during 1955. Intended to use the same launcher as **Seaslug**. Cancelled in 1956 but Seaslug was given a secondary anti-ship role in its place. (Nickname to match Seaslug and sound like MoS 'rainbow' codename?).

**Blue Steel**: 100-mile-range powered guided bomb, produced by Avro in response to Air Ministry requirement OR.1132 of 1954. Emergency CA release (acceptance into RAF service) issued Sept 1962 and full release by 1964. A deliverable stockpile of 48 was produced and the last were withdrawn from service in 1969 or 1970. The warhead, specified in Air Ministry requirement OR.1141 of 1955, was originally intended to be **Green Bamboo**. In 1957 **Green Grass** was substituted and by 1958 there were serious studies of a **Granite-type** warhead for Blue Steel. OR.1141 was cancelled in 1959 and Blue Steel finally entered service with a **Red Snow** warhead. Two Air Ministry requirements were issued for longer-range

successors to Blue Steel: the ambitious OR.1149 in 1956 for a 1000-mile-range weapon and the more realistic OR.1159 in 1958 for 600-mile range with a new lighter warhead to OR.1160. Either of these requirements could have been met by **Skybolt**; the second could also have been met by Blue Steel Mk.2, a project that was cancelled at the start of 1960. (Official MoS 'rainbow' codename).

**Blue Stone**: codename used for external neutron initiator (ENI) devices, or perhaps at first, strictly speaking, for the specific initiator used in the **Green Grass** warhead. (Official MoS 'rainbow' codename).

**Blue Streak**: medium-range ballistic missile (MRBM), designed by De Havilland. Work began several years before the formal Air Ministry requirement OR.1139 was issued in July 1955 (2nd issue 1959). The associated warhead requirement OR.1142 originally specified **Green Bamboo**, but in Nov 1955 **Orange Herald** was substituted. During 1958 there were serious discussions of using a **Granite-type** warhead, then in Nov 1958 **Red Snow** was chosen. In 1959 the separate OR.1142 was cancelled. Blue Streak itself was cancelled at the beginning of 1960, a decision announced in April, by which time US agreement had been secured to supply **Skybolt** in its place. (Official MoS 'rainbow' codename).

**Blue Water**: 30 (later 75)-mile-range surface-to-surface guided weapon to replace **Corporal**, designed by English Electric to meet a War Office requirement. Called Red Rose until 1957. Draft requirement for a nuclear warhead circulated Aug 1957 and soon associated with **Indigo Hammer**, although the War Office were interested from the outset in getting higher yield for certain targets, including dug-in infantry and armoured penetrations across a front line of 600yd or more. **Red Beard** and 'mixed' Indigo Hammer warheads were briefly mentioned but after the resumption of Anglo-American cooperation in late 1958 it was decided to fit Blue Water with **RO106** incorporating **Tony**. The War Office remained for several years unhappy with the low yield of this warhead, and pressed for higher-yield alternatives including **Una**, **Ulysses**, versions of the **Skybolt** warhead or American **Project E** weapons. By 1962 a specific high-yield Blue Water warhead GM462 (nicknamed 'Big Brother') was under discussion. Blue Water was cancelled in August 1962. (Official MoS 'rainbow' codename).

**Brown Bunny**: see **Blue Peacock**.

**Buffalo**: test series at Maralinga in Sep-Oct 1956. (Official MoD operation codename?).

**Burgee**: a gas-boosted primary design tested at Grapple-Z on 23 Sep 1958. (AWRE nickname?).

**Charcoal**: UK '**Polaris** economy test' in Nevada on 10 Sept 1965. Repeat of the unsuccessful **Courser** test. (US codename).

**Chevaline**: UK **Polaris** improvement programme incorporating hardening and penetration aids. The first serious study of improving Polaris penetration of Soviet ABM defences was undertaken in 1964 under the designation HR169, taking advantage of some earlier work on **Blue Streak** penetration. By 1967 Polaris improvement was under serious discussion at ministerial level. By 1968 the main options under consideration in Whitehall were the US **Antelope**; the conceptually

similar UK Super Antelope with a greater degree of hardening and more decoys, building on the lessons of HR169; and a small super-hard warhead with a greater number of re-entry bodies and a new MIRV-like re-entry body delivery system. Numerous other options had been explored at working level. Feasibility studies along the lines of Super Antelope continued under the designation KH793 and the **Artificer** security codename from 1970, and KH793 became Chevaline in March 1974. Chevaline replaced the three original Polaris re-entry bodies with two re-entry bodies and a variety of penetration aids. The warhead, yielding about 200kt, was closer to the US Mk.58 than the original UK Polaris warhead had been; after a series of tests starting in 1974 its design was complete by 1980. The delivery system entered service in 1982. Multiplying 4 submarines by 16 missiles by 2 warheads gives a maximum deliverable stockpile of 128. Missile with Chevaline was referred to as Polaris A-3TK. Chevaline remained in service until the final patrol of HMS *Repulse* in 1996. (Official MoD codename?).

**Cleo**: a UK thermonuclear primary design of 1962, based on the **Super Octopus** principle. More compact and safer than **Tony** for the same yield, and using British high explosive. (AWRE nickname?).

**Conifer**: security codeword covering significant warhead design information; more sensitive than **Atomic**.

**Cormorant**: UK research test in Nevada on 17 July 1964. Nature unclear, but apparently did not generate the expected yield. (US codename).

**Corporal**: US surface-to-surface missile produced by Firestone and used by the British Army in Germany. The UK **Violet Vision** warhead was proposed for Corporal but the missile eventually entered service in 1959 with a US **Project E** warhead. On withdrawal in 1966 it was replaced, not directly by **Blue Water** as originally intended, but indirectly by **Honest John**. (US codename).

**Courser**: UK 'Polaris economy test' in Nevada on 25 Sept 1964. Failed due to a fault in US neutron-injection equipment but later repeated at test **Charcoal**. (US codename).

**Cudgel**: projected atomic naval mine to meet Admiralty requirement USW.300 of 1954 for carriage by mini submarines. Originally intended to use the same warhead as **Blue Danube**; later as **Red Beard**. The requirement was cancelled by June 1956. (Official Admiralty codename, first seen Nov 1954).

**Davy Crockett**: US Army spigot mortar with nuclear warhead. The War Office was interested in a UK version between at least Feb 1959 and spring 1962, proposing to buy several hundreds, and AWRE investigated a UK sub-kiloton warhead to match, probably based on the US design (see **Purple Passion**). (US codename).

**Dick**: generic name for an H-bomb secondary. (AWRE nickname).

**ET317**: the British warhead for **Polaris**, according to published sources based on the same ideas as the planned **Skybolt** and **WE177** warheads, but with reduced diameter and changed weight distribution in order to fit the Polaris re-entry body. (Official MoA digraph/trinome).

**Flagpole:** a two-stage H-bomb design derived from the **Granite-type**, using **Indigo Hammer** as its primary and tested at Grapple-Z on 2 Sep 1958. (AWRE nickname?).

**Genie:** US air-to-air unguided rocket with Mk.25 nuclear warhead. Informally offered to the Chief of the Air Staff by his US counterpart in 1958, and of interest to the Air Ministry, for use on the Lightning fighter and with a **Project E** warhead, until 1960. Also referred to by the Air Ministry as Rocket Projectile 3 or RP3. (US codename).

**GM462:** see **Blue Water**.

**Granite-type:** generic name for the family of two-stage H-bomb designs with spherical secondaries developed by AWRE between 1955 and 1958, beginning with **Green Granite**. Variants of Green Granite included Short Granite (also Green Granite II or Green Granite Small), which was smaller and lighter (30in diameter and 2 tons) and with **Tom** and **Dick** in closer proximity, tested on 15 May 1957; Blue Granite, which emerged at short notice in May 1957 and possibly incorporated **Indigo Hammer** as the primary, but was not tested; Purple Granite, which emerged even later in the day and was tested on 19 June 1957; and further devices tested in the Grapple-X, Y and Z series in 1957-58 including **Flagpole**.

**Grapple:** test series in the Pacific at Malden Island and Christmas Island in 1957-58, comprising Grapple in May-June 1957, Grapple-X in Nov 1957, Grapple-Y in Apr 1958 and Grapple-Z in Aug-Sep 1958. Originally Gazette. Planned Grapple-M, N and O series in 1959 and 1960 were cancelled. (Official MoD operation codename?).

**Green Bamboo:** tamper-boosted 'layer cake' H-bomb design. Originally referred to in 1954 as Type A thermonuclear (cf. Type B or **Green Granite**) and pursued at higher priority than Type B for use in **Yellow Sun**, **Blue Steel**, **Blue Streak** and **Blue Rosette**. Size and weight varied over time with refinement of the design, but eventually around 4000lb warhead weight, 45in diameter and 1Mt planned yield. Used a 72-lens implosion system and ENI. Although not thought to be a complex or advanced design, Green Bamboo eventually proved difficult to assemble; it was taken to Christmas Island but not fired during the **Grapple** trials. In August 1957 it was decided to substitute **Green Grass** in the remaining requirements for which Green Bamboo had been envisaged. (Official MoS 'rainbow' codename allocated spring 1955).

**Green Cheese:** air-to-surface anti-ship missile designed by Fairey in response to joint Admiralty/Air Ministry requirement AW.319/OR.1123 of 1952/3. There was some discussion in 1955 of a version with a **Red Beard** nuclear warhead. The missile was cancelled in 1956. (Official MoS 'rainbow' codename allocated Sep 1953).

**Green Flax:** see **Yellow Temple**.

**Green Granite:** two-stage H-bomb design. Originally referred to in 1954 as Type B thermonuclear (cf. Type A or **Green Bamboo**) but pursued at lower priority than Type A – for trials at **Grapple**, and for use in future multi-megaton warheads as described in draft Air Ministry requirement OR.1153. Used a development of **Red Beard** as the primary and a spherical secondary. Size, weight and predicted yield varied over time with refinement of the design, but eventually around 8ft long x 48in



diameter and 1Mt predicted yield. Known by 1957 as Green Granite I, Green Granite Large or Long Granite, to differentiate it from Short Granite; not eventually tested in its original form, but spawned a series of other **Granite-type** designs. (Official MoS 'rainbow' codename allocated spring 1955).

**Green Grass**: pure-fission 'megaton' warhead based on a design referred to by AWRE as Knobkerry. Used the 45in diameter 72-lens implosion system of **Green Bamboo** and the fissile core of **Orange Herald**. Adopted in August 1957 as the warhead for **Violet Club**, **Yellow Sun** and **Blue Steel** pending the further development of **Granite-type** designs. Used **Blue Stone** ENI, and for safety the hollow core of fissile material was filled with steel ball-bearings until arming. Yield was estimated in 1959 as 400kt. Green Grass was in service between 1958 and 1962 in Violet Club and Yellow Sun Mk.1. (Official MoS 'rainbow' codename allocated Aug 1957).

**Green Parrot**: mentioned in a *New Statesman* article by Duncan Campbell. Meaning uncertain and not found elsewhere.

**Gwen**: warhead design probably of US origin considered in 1959 for use in at least **RO106**, **Violet Mist** and **Seaslug**. Yield given as 0.5-2kt. (AWRE nickname?).

**Halliard**: name given to a number of three-stage H-bomb designs, one of which was tested at Grapple-Z on 11 Sep 1958. (AWRE nickname?).

**Honest John**: US Army 20-mile-range unguided surface-to-surface rocket with nuclear warhead. The War Office was interested by 1959 and the missile entered service with the British Army in 1962 with a **Project E** warhead. It indirectly replaced the more capable but less practical **Corporal**, and was withdrawn in 1979 upon replacement by **Lance**. (US codename).

**HR169**: see **Chevaline**.

**Hurricane**: the UK's first atomic test in the Montebello Islands in Oct 1952. (Official MoD operation codename?).

**Hybrid**: see **Stag**.

**Ikara**: anti-submarine torpedo-carrying missile, developed in Australia, which entered service on Royal Navy ships from 1973. There were suggestions between at least 1963 and 1966 of a nuclear payload for Ikara, based on the low-yield A version of **WE177**, but the idea was eventually rejected. (Australian codename).

**Indigo Hammer**: small fission warhead intended for defensive missiles and as a thermonuclear primary in some **Granite-type** designs. Nuclear warheads for surface-to-air guided weapons (SAGW) were discussed from 1955 and Air Ministry requirement OR.1140 for investigations into a 300lb, 20in diameter warhead was issued in 1956 (see **Blue Envoy**). By May 1957 AWRE had designed the 5-10kt, 400lb, 20in diameter x 45in long Blue Fox warhead with SAGW and other missile requirements in mind, and potentially for use as a thermonuclear primary. This was an all-plutonium unboosted design and was tested on 25 Sep 1957, yielding 6kt. The name Blue Fox had meanwhile been compromised and changed to Indigo Hammer. Early in 1958 it was decided to drop most RAF and Army nuclear

SAGW requirements and concentrate on command-guidance Red Duster (see **Bloodhound**). Indigo Hammer remained under development to meet this and the **Blue Water** and thermonuclear primary requirements, and a version was incorporated in the **Flagpole** device tested on 2 Sep 1958, but the warhead was cancelled after the resumption of atomic cooperation with the US. (Official MoS 'rainbow' codename).

**Katie**: the British primary for **Skybolt** and **WE177**, based on the **Super Octopus** idea. (AWRE nickname).

**KH793**: see **Chevaline**.

< span lang=EN-GB style='font-size:12.0pt; mso-bidi-font-size:10.0pt;font-family:Arial;mso-bidi-font-family:"Times New Roman"'>**Kittens**: minor atomic trials at Emu Field and Maralinga between 1953 and 1961 to investigate the performance of neutron initiators. (AWRE nickname?).

**Knobkerry**: see **Green Grass**.

**Lance**: US Army surface-to-surface missile. The MoD considered adopting a version with a UK warhead in 1966, and again in 1971. The missile eventually entered service with the British Army using a **Project E** warhead in 1976, and was withdrawn in 1991 or 1992. (US codename).

**Lighthouse**: cancelled test series originally planned for Maralinga in 1959.

**Little John**: US Army air-transportable unguided surface-to-surface rocket. The War Office was interested in a British version during 1961. (US codename by association with **Honest John**).

**Long Granite**: see **Green Granite**.

**Mosaic**: test series in the Montebello Islands in May-June 1956. Originally Giraffe. (Official MoD operation codename?).

**Octopus**: see **Super Octopus**.

**Option M**: a "de-MIRVed" version of **Poseidon** which was suggested to the UK by the US as an alternative to **Chevaline** during 1973 but not eventually pursued. (Origin uncertain).

**Orange Herald**: one-ton core-boosted fission warhead for **Blue Streak**, designed to meet Air Ministry requirement OR.1142 and adopted in Nov 1955. Diameter up to 39in in the original design (later known as Orange Herald Large), or 30in in Orange Herald Small with less high explosive, which was tested on 31 May 1957. Used a 32-lens implosion system. The effect of boosting in the tested warhead was unclear and perhaps as a result Orange Herald was sometimes described as a pure-fission design. Also briefly of interest for **Blue Rosette**, and to the Admiralty in 1956 as a warhead for a megaton bomb for naval aircraft. Consideration was given to a filling of steel ball-bearings for safety, as in **Green Grass**. Superseded in 1958/9 by **Red Snow**. (Official MoS 'rainbow' codename).

**Pampas:** UK test of a thermonuclear primary based on the **Super Octopus** principle in Nevada on 1 March 1962. (US codename).

**Pendant:** a solid-boosted primary design tested at Grapple-Z on 22 Aug 1958. (AWRE nickname?).

**Peter:** primary for **Red Snow**; anglicised version of **Python**. (AWRE nickname).

**Pixie:** experimental small fission warhead, weighing around 250lb and tested on 14 Sept 1957, yielding 1kt. Associated by the service ministries with, although not in fact designed to meet, the requirement for a **Seaslug** warhead; also considered for **Red Duster** or **Yellow Temple**, but not in this context thought to offer any performance advantage over **Indigo Hammer**, which these missiles would be able to carry. Pixie was thought extravagant in fissile material and inadequately safe, and was cancelled after the resumption of atomic cooperation with the US. (AWRE nickname, presumably on account of small size).

**Polaris:** US fleet ballistic missile system, developed in response to a US Navy requirement of 1956. Lockheed (later Lockheed-Martin) was lead contractor for the missile. Polaris was adopted as the UK's strategic deterrent system in December 1962 following the cancellation of **Skybolt**. In 1963 the UK's choice of the A-3T variant of Polaris, with hardened missile electronics (see **Topsy**), 2500-mile range and three warheads, was confirmed. The UK chose to fit its own warheads (see **ET317**), rather than the Mk.58 used by the US; the UK warhead was perfected after the **Courser** and **Charcoal** tests in Nevada. Four Polaris submarines entered service with the Royal Navy from 1968, each carrying 16 missiles and 64 warheads for a maximum deliverable stockpile of 256. Published accounts suggest only three submarines' worth of warheads were stockpiled. Polaris was later upgraded under the **Chevaline** programme. (US codename).

**Poseidon:** US fleet ballistic missile system, developed as a MIRVed successor to **Polaris**. At various points between 1965 and at least 1973 the UK considered purchasing Poseidon or various elements of Poseidon (see **Stag**, **Option M**) as alternatives to **Chevaline**, but the overall system was never formally offered by the US nor requested by the UK. (US codename).

**Project E:** arrangement under which US-built nuclear weapons and/or warheads, kept in the UK and Germany under US custody in peacetime, were to be made available for use on RAF aircraft and missiles in the event of war. Perhaps originally referred to the subset of US weapons made available for use specifically by V-bombers in the strategic bombing role, but later used more widely, even to refer to similar arrangements for the Army. The arrangement was discussed as early as 1954 and became effective in 1958. Various US weapons were covered, beginning (for the RAF) with the Mk.5 atomic bomb and later extending to Mk.7, Mk.15/39, Mk.28 and Mk.43 bombs, **Thor** missile warheads and nuclear depth bombs; and (for the Army) **Corporal**, **Honest John**, **Lance**, atomic landmine and artillery warheads. Project E warheads were discussed for several other weapons without entering service. Project E weapons were replaced by **Yellow Sun** Mk.2 on V-bombers in the strategic bombing role in March 1962 but continued in use by the RAF in Germany until replaced by **WE177** in 1969, and by RAF Nimrods and the Army until 1992. (Air Ministry codename?).

**Project N:** a Royal Navy equivalent of **Project E**, discussed at least during 1958 and 1960, but not in the end pursued because of the difficulty of custody arrangements on board ship. Later also used to refer to the carriage of US nuclear weapons by RAF maritime patrol aircraft.

**PT176:** see **WE177**.

**Purple Granite:** see **Granite-type**.

**Purple Passion:** sub-kiloton warhead for **Davy Crockett**. (Army nickname).

**Python:** US primary in amongst other weapons Mk.28. Anglicised as **Peter**. (US codename).

**R-1:** codename for investigations into the vulnerability of an attacker's nuclear warheads to neutrons from nearby defensive nuclear explosions. Sometimes referred to as a project, sometimes as an effect, sometimes simply as R-1. R-1, also described as 'neutron poisoning,' was understood to cause a significant drop in the yield of the attacking warhead for a time after the defensive explosion. For a time after 1956 it was of great concern to British warhead designers: it gave impetus to nuclear surface-to-air guided weapons projects, and much work was done to develop 'immunity' against R-1 for the primaries of **Granite-type** H-bomb designs. (Air Ministry codename?).

**Rats:** minor atomic trials at Maralinga between 1957 and 1960 to investigate implosion timing and compression; similar to Tims but instrumented differently. (AWRE nickname?).

**RE179:** see **Skybolt**.

**Red Beard:** tactical fission bomb produced in response to joint Admiralty/Air Ministry requirement AW.330/OR.1127 issued in Nov 1953 (discussions as early as 1951; 2nd issue Nov 1955; 3rd issue Mar 1956; 4th issue Apr 1958). Used an all-plutonium warhead with a smaller and more advanced implosion system than **Blue Danube**, incorporating 'air lenses.' Weapon weight 2000lb, 154in long x 28in diameter. Original yield requirement 10kt; mixed and boosted versions of up to 50kt were discussed but service versions had a nominal yield of 15kt. The warhead was also developed with use as an H-bomb primary in mind – versions were tested as such in **Granite-type** designs – and had potential applications in **Cudgel**, **Green Cheese**, **Violet Mist**, **Violet Vision** and the nuclear depth charge to OR.1156. After much chopping and changing of the requirement during the 1950s, in-service Red Beard weapons were either "ballistic" for free-fall delivery by RAF V-bombers or "loft" for LABS (toss-bombing) delivery by Royal Navy aircraft and RAF Canberras. The warhead too existed in two versions: Red Beard Mk.1 with ground loading of the fissile core, and Red Beard Mk.2 with in-flight loading and fewer environmental limitations. Most Mk.1 warheads were converted to Mk.2 in 1961-2. The first Red Beard weapons were completed in 1959 but the earliest service approval was not granted until April 1960. By the end of 1962 the RAF had a deliverable stockpile of 110 Red Beards; the Royal Navy's stockpile of 28 was completed some time later. The weapons were withdrawn at the start of the 1970s and replaced by **WE177**. Red Beard was known in the early 1950s as the 'Javelin bomb' (after one of the RAF aircraft that would have carried it) or, to mislead

deliberately, as the 'Target Marker Bomb.' In service it became 'Bomb, Aircraft, HE 2000lb MC.' The name Red Beard was also loosely used to refer to the warhead. (Official MoS 'rainbow' codename, first seen Sep 1954).

**Red Duster:** see **Bloodhound**.

**Red Rose:** see **Blue Water**.

**Red Shoes:** see **Yellow Temple**.

**Red Snow:** anglicised version of the US Mk.28 two-stage H-bomb warhead, differing in particular in the use of British high explosive around the primary (**Peter**). Weight c.1700lb, 60in long x 21.5in diameter, yield 1Mt. Adopted in Nov 1958 after the resumption of cooperation with the US as the common warhead for **Yellow Sun** Mk.2, **Blue Steel** and **Blue Streak**. Also associated for a time around 1959 with the **Skybolt** warhead requirement and with various schemes for tactical warheads with yields below 1Mt, for example in **Red Beard** or "tailored bomb" cases (the US Mk.28 was capable of a variety of yields). Air Ministry requirement OR.1171 of 1959 for a common megaton warhead capsule was produced with Red Snow in mind, and not vice versa. (Official MoS 'rainbow' codename?).

**RO106:** common warhead assembly or capsule for **Blue Water**, **Seaslug** and command-guidance **Bloodhound**. First mentioned Feb 1959, when **Tony** and **Gwen** were possible alternative warhead payloads; Tony was selected. 8.5kt yield estimated in 1962. Almost reached production before the three associated weapons requirements were cancelled: Bloodhound in 1960 or 61, Seaslug in June and Blue Water in August 1962. (Official MoA digraph/trinome).

**RP3:** see **Genie**.

**Sea Dart:** naval surface-to-air guided weapon developed by Hawker-Siddeley (later BAe Dynamics). A nuclear warhead was discussed during 1966 but not pursued; the conventional version of the missile entered service on the destroyer HMS *Bristol* in 1973. Also known by the MoA digraph/trinome CF299. (Manufacturer's trade name?).

**Seaslug:** naval surface-to-air guided weapon produced by Armstrong Whitworth as the culmination of Admiralty work begun as long ago as 1944. Nuclear warhead was suggested in 1955 to deter air attack on the fleet, deal with formation attack and offer a secondary anti-ship or shore bombardment capability. Associated successfully with **Pixie** and **Winkle**. AWRE planned work in 1959 to weaponise a British warhead design for Seaslug, but after the resumption of atomic cooperation with the US **RO106**, incorporating **Tony**, was adopted. At this stage improvements to the basic Seaslug Mk.1, including greater range, IR fuzing and the nuclear warhead, were separated out into a Seaslug Mk.2 project. The nuclear warhead was cancelled in June 1962 but the conventional Seaslug entered service with the Royal Navy later the same year, and Seaslug Mk.2 in 1965. See also **Blue Slug**. (Admiralty codename).

**Short Granite:** see **Granite-type**.

**Skybolt:** air-launched ballistic missile designed by Douglas in the US, where it was also known as WS138A (for Weapons System 138A) or GAM-87. Originally of interest to the Air Ministry to meet requirement OR.1149 or 1159 for a long-range successor to **Blue Steel**. The missile and its warhead were joint UK/US requirements as early as Jan 1959. Initial warhead options discussed by Brundrett and the Chiefs were **Red Snow** or a **Project E** warhead. The Air Ministry were more interested in a lighter warhead such as the US Mk.47 or a British equivalent, but Mk.47 was uneconomic in fissile material. When **Blue Streak** was cancelled, Skybolt became Britain's planned strategic deterrent system and it became impossible to use a Project E warhead; a new UK Skybolt warhead requirement OR.1179 was issued by the Air Ministry. Hopes were expressed that the Skybolt warhead could form the basis of a family of designs. At the end of 1960 the US (and UK jointly?) decided to use the US Mk.59 warhead for Skybolt; it was to be anglicised as RE179. In mid 1962 the UK decided to substitute a UK-designed primary, based on the **Super Octopus** principle, for the US Mk.59 primary. This UK primary became **Katie**. The Skybolt missile was cancelled by the US in December 1962 but the warhead continued in development in the UK as the basis for the **Polaris** and **WE177** family. (US codename).

**Stag:** a hybrid of the **Poseidon** missile with a UK Super Antelope front end, suggested as an alternative to **Chevaline** during 1972 but not eventually pursued. Originally described simply as Hybrid. (Origin uncertain).

**Super Antelope:** see **Chevaline**.

**Super Octopus:** UK implosion system for fission weapons and thermonuclear primaries, based on work on Octopus ("an alternative to baratol and air lenses") dating to 1957 or earlier and tested in 1958. Super Octopus was the basis for two devices tested underground in Nevada in 1962, for **Cleo**, **Katie** and probably other later designs. (AWRE nickname).

**Tendrac:** UK test of the **Katie** thermonuclear primary in Nevada on 7 Dec 1962. Used more high explosive and less fissile material than the preceding **Pampas** test. (US codename).

**Thor:** US intermediate-range ballistic missile (IRBM), developed by Douglas. Basing the missile in the UK was discussed at governmental level in 1956 and agreement was reached in 1958 to sell the missile to the RAF for use with a **Project E** warhead. Initial political interest in an anglicised version of the Thor warhead, or a joint UK-US warhead development for the missile or a successor, was not followed up. 60 Thor missiles entered service with the RAF starting in 1959, and were withdrawn in 1963. (US codename).

**Tims:** minor atomic trials at Maralinga between 1955 and 1963 to investigate implosion timing and compression; similar to Rats but measured differently. (AWRE nickname?).

**Tom:** generic name for an H-bomb primary. (AWRE nickname).

**Tony:** anglicised version of the US **Tsetse**, differing in particular in the use of UK high explosive. It was decided in November 1958 to produce Tony to meet various kiloton weapons requirements, first **Bloodhound**, possibly **Violet Mist** and later

depth charges and others (see **RO106**); also finally as a primary for at least **Una** and the **Skybolt** warhead. These requirements were all cancelled by the end of 1962. Tony was described as weighing 175lb and measuring 34in long x 14½in diameter; design yield varied from 1-10kt. Perhaps briefly known in late 1958 as **Blue Cat**. Air Ministry requirement OR.1172 of 1959 was produced with Tony in mind, and not vice versa. (AWRE nickname).

**Topsy**: US project to harden **Polaris** missile electronics. Built into US and UK service missiles, referred to as Polaris A-3T. Topsy became part of the wider **Antelope** study of Polaris improvement. (US codename).

**Totem**: test series at Emu Field in Oct 1953. (Official MoD operation codename?).

**Trident**: US fleet ballistic missile system, successor to **Polaris** and Poseidon. Developed in response to US Navy requirements for enhanced range and accuracy from the mid 1960s. Lockheed (later Lockheed-Martin) was lead contractor for the missile. Trident C-4 was adopted as the UK's strategic deterrent system in July 1980 but it was the D-5 version which entered service, with the first patrol of HMS *Vanguard*, in 1993. (US codename).

**Tsetse**: US name for the primary of a number of warheads including Mk.44 and Mk.59. Anglicised as **Tony**. (US codename).

**Type A**: see **Green Bamboo**.

**Type B**: see **Green Granite**.

**Ulysses**: warhead design associated in 1961 with the requirements for **Blue Water** and the later **WE177**. Yield described as 50-100kt. (AWRE nickname?).

**Una**: warhead design associated in 1959/60 with the requirements for **Blue Water**, a depth charge, possibly an ABM and in particular the later **WE177**. Yield described as 50-200kt and weight 700lb. Una seems to have been a two-stage design with **Tony** as the primary. It was not expected to become available before 1964/5. (AWRE nickname?).

**Violet Club**: interim megaton weapon incorporating the **Green Grass** warhead in a **Blue Danube** bomb casing. First suggested in August 1956 as an interim response to Air Ministry requirement OR.1136, when it was thought one of the warheads to be tested at **Grapple** could be available before the **Yellow Sun** bomb casing and other components. Production of an interim megaton weapon was approved in Nov 1956, Green Grass was chosen as the warhead in 1957 and the first Violet Club was delivered to the RAF in March 1958. A deliverable stockpile of 5 had probably been built up by the end of the year when Violet Club was succeeded in production by Yellow Sun Mk.1. These bombs were withdrawn, and the warheads reused in Yellow Sun Mk.1, during 1959. Weighed slightly less than Blue Danube at 9000lb; dimensions similar and yield nominally 400kt. Known in service as 'Bomb, Aircraft, HE 9000lb MC.' (Official MoS 'rainbow' codename allocated Aug 1957).

**Violet Mist**: atomic landmine for the Army. Proposal early in 1957 to use a **Red Beard** type warhead; later in 1957 there were other options including **Indigo**

**Hammer.** Early in 1959 the possibility of a lighter warhead (**Gwen** or **Tony**, or perhaps **Peter**) revived interest in Violet Mist, but there was no serious consideration beyond 1961 and the Army used **Project E** atomic landmines instead. Blue Badger and Blue Hare were originally offered as codenames but were thought too similar to **Blue Bunny**. (Official MoS 'rainbow' codename).

**Violet Vision:** UK warhead for **Corporal**, based on **Red Beard** but possibly with greater yield. War Office requirement issued 1955 and cancelled in 1957 in favour of a **Project E** warhead. (Official MoS 'rainbow' codename).

**Vixen:** minor atomic trials at Maralinga between 1959 and 1963 to investigate warhead safety in fires (Vixen-A) or near conventional explosions (Vixen-B). (AWRE nickname?).

**WE177:** family of tactical bombs produced initially in response to Air Ministry requirement OR.1177. Thinking began as early as 1958; requirements for the bomb and accompanying warhead (OR.1176) were issued in Aug 1959 and called for an "improved kiloton bomb" also commonly referred to for several years as the "**Red Beard** replacement." The yield originally specified was 10-300kt. At first the Air Ministry was mainly interested in carrying the bomb on the TSR.2 aircraft. The weapon became joint Admiralty/Air Ministry requirement GD.10/OR.1177 in May 1960. At first the OR.1176 warhead requirement was to have been met by **Una**, but by mid-1960 there were discussions of a common warhead for OR.1177 and **Skybolt** and in 1961 the weapon was briefly associated with a warhead called **Ulysses**; the relationships if any between these warhead designs are unclear. By mid 1962 a common Skybolt/OR.1177 warhead or family of warheads, based on the US Mk.59, was again favourite, but it was decided to substitute a UK-designed primary (**Katie**) for the Mk.59 primary (**Tsetse/Tony**). Later in 1962 a depth charge version of the weapon was approved and early in 1963 a high-yield variant was given priority as a weapon for the V-bomber force to plug a "deterrent gap" until the delivery of Polaris. This high-yield variant, weighing 950lb, measuring 133in long x 16in diameter and yielding 450kt, entered service as WE177B in 1966. The warhead for WE177B was known as ZA297, and the weapon (in service) as 'Bomb, Aircraft, HE 950lb MC.' WE177A, weighing 600lb, 112in long and yielding either ½kt (for anti-submarine use) or 10kt, entered service at the end of the 1960s with both the Royal Navy and RAF. Its warhead, essentially ZA297 without a fusion secondary, was known as PT176 and the weapon (in service) as 'Bomb, Aircraft, HE 600lb MC.' In the early 1970s a final version WE177C, of similar size and weight to WE177B but with a yield of about 200kt, entered service in response to a NATO requirement for carriage on tactical aircraft based in Germany. The eventual deliverable stockpile of WE177 weapons is unclear but published accounts suggest around 200-250. (Probably official MoA digraph/trinome, not commonly used until the mid-1960s).

**Winkle:** an AWRE warhead design associated during 1958 with the **Seaslug** requirement. (AWRE nickname, possibly by facetious association with Seaslug, another distantly related kind of mollusc).

**WS138A:** see **Skybolt**.

**Yellow Anvil:** UK design for a nuclear artillery shell warhead for the Army with a yield of 1kt. Discussed in 1957; a test at **Lighthouse** was a possibility. Abandoned



after the resumption of atomic cooperation with the US in 1958. (Official MoS 'rainbow' codename).

**Yellow Sun:** megaton free-fall bomb produced in response to Air Ministry requirement OR.1136, drafted Jul 1954 and issued Jun 1955 (2nd issue Mar 1957, 3rd issue May 1959). Weight 7000lb. 240in long x 48in diameter. Original yield requirement for up to 20Mt was modified as knowledge of H-bomb design improved, settling at 1Mt in 1957, with greater yields desirable in future. The first warhead firmly associated with the requirement, in 1955, was **Green Bamboo**. By 1957 the Air Ministry hoped to be able to use a **Granite-type** warhead in Yellow Sun "Stage 2" but had to accept **Green Grass** in Yellow Sun Stage 1. In Nov 1958, following the resumption of atomic cooperation with the US, plans were revised again: Yellow Sun Mk.1 would use Green Grass and Yellow Sun Mk.2 would use **Red Snow**. Mk.1 deliveries began in Jan 1959; warheads from Violet Club were later recycled into Yellow Sun Mk.1 casings and a deliverable stockpile of 37 was built up by the end of 1961, to be withdrawn in 1963. Yellow Sun Mk.2 was delivered to the RAF beginning in 1961; a deliverable stockpile of probably 86 was built up and these weapons were withdrawn in 1966 or possibly slightly later. Also known (in service) as 'Bomb, Aircraft, HE 7000lb HC.' (Official MoS 'rainbow' codename, first seen Mar 1956).

**Yellow Temple:** surface-to-air guided weapon development of the earlier Red Shoes, designed by English Electric to meet Army and RAF requirements. A nuclear warhead for Red Shoes was discussed within the War Office as early as 1955/56 but no formal requirement was issued; the conventional version of this weapon eventually entered service with the Army as Thunderbird Mk.1. A development with greater range and performance was begun as Green Flax and renamed Yellow Temple in 1957. A nuclear warhead for Yellow Temple was suggested – either **Indigo Hammer**, which might have been too large, or **Pixie** – but this aspect of the requirement was cancelled in early 1958. A conventional improvement of Thunderbird Mk.1, against a less ambitious requirement than Yellow Temple, eventually entered service as Thunderbird Mk.2. (Official MoS 'rainbow' codename).

**ZA297:** see **WE177**.