The nuclear weapons programme

Blue Danube

Britain's first operational nuclear bomb (1953-60)
Type A-bomb
Diameter 1.52 metres/60 inches
Length 7.31 m/288 in
Weight 4,650 kilograms/10,250 lb
Year tested 1953
Yield 15 kilotons

Red Beard

Operational from 1961 to 1971
Type A-bomb
Diameter 0.91 m/36 in
Length 3.65 m/144 in
Weight 794 kg/1,750 lb
Year tested 1956
Yield 20 kilotons

Yellow Sun

Operational from 1958 to 1970
Type H-bomb
Diameter 1.21 m/48 in
Length 6.40 m/252 in
Weight 3,175 kg/7,000 lb
Year tested 1957
Yield 1 megaton or more

The end of World War II saw an end to the agreements between Britain and the United States to share developments in weapons technology. As a result, British scientists (usually sporting fantastic beards) working at the Atomic Weapons Establishment at Aldermaston, Berkshire under the leadership of nuclear physicist Sir William Penney were forced to work in isolation.

The physics and maths of nuclear weapons were well understood by the 1950s, but the reality of building an atomic bomb was a combination of laboratory experimentation and live firing tests.

All-powerful

After coming up with the Hurricane atomic device, successfully tested in 1952, the scientists' goal was to create a new, all-powerful thermonuclear device – a hydrogen bomb, or H-bomb. The bombs dropped on Hiroshima and

Nagasaki (called, respectively, Little Boy and Fatman) had been atomic bombs, or A-bombs, a term that is slightly misleading as all nuclear weapons use atomic reactions.

- An **A-bomb** is a *fission* weapon whose explosive force, or yield, comes from the splitting of atoms. When an unstable isotope such as uranium 235 (as in Little Boy) or plutonium 239 (Fatman) is bombarded with neutrons, its atoms are split and create a chain reaction that results in a massive release of energy.

- The thermonuclear device known as an **H-bomb** is a *fusion* weapon. It uses an A-bomb to create fantastically high temperatures (hence 'thermonuclear') that cause light atoms – usually the hydrogen isotopes deuterium and tritium – to fuse together to form heavier (usually helium) atoms. The forcing together of the nuclei of these atoms releases an enormous amount of atomic energy; this is essentially how the sun works. The yield of the H-bombs is approximately 100 times greater than that of the original A-bombs.

Orange Herald

Theory was all very good, but for these devices to have any deterrent effect, they had to be tested out in the world. From 1953, bomb tests were carried out in Australia – first, in the Emu Field in South Australia, then on the Monte Bello Islands, and finally on the Maralinga test range, also in South Australia.

From 1957, the Grapple series of nuclear tests were held in the South Pacific. In May of that year, three bombs were tested. Two of them – Green Granite Small and Purple Granite – were experimental H-bombs. The third, Orange Herald, was labelled an H-bomb but was really an A-bomb in disguise – one built on a massive scale and designed to guarantee a big bang for the world to see if the two real H-bombs didn't work.

In the end, the two H-bombs produced relatively low yields of between 150 and 300 kilotons (equivalent to the detonation of 150,000-300,000 tons of TNT). But Orange Herald produced a massive yield of over 700 kilotons, and Britain was finally taken seriously as a nuclear power.

Round C

While the world had been duped into thinking that Britain had a thermonuclear device, the scientists were busy trying to make one that actually worked, spurred on by the likelihood of a ban on atmospheric testing (which eventually came into effect in 1963). The tests in the South Pacific continued, with better designs and greater success. The Grapple X test on 8 November 1957 produced Britain's first successful thermonuclear detonation.

The bomb, called Round C, worked perfectly. Dropped from a Valiant V-bomber over the northern limits of Christmas Island, it exploded in the air 2,250 metres off the ground. In the first 70 millionths of a second, the A-bomb trigger exploded. Then a colossal flux of X-rays caused the fusion of hydrogen isotope atoms. One second after detonation, the bomb erupted with 1.8 megatons of energy (equivalent to the explosive force of 1,800,000 tons of TNT). As Bill Evans of the Valiant air crew remembers, 'Even with your sunglasses on and your beret and hands pressed over your eyes, you could still see the bones in your fingers.'

Co-operation

By 1958, Britain had managed to perform several extra experiments and refine their weapons. Grapple Y, held in April 1958, produced a massive 3 megaton yield, while the Grapple Z tests confirmed the success of the more practical 1-ton/1-megaton Pennant 2 warhead.

This achievement caught the attention of the Americans, and Britain willingly negotiated terms for a re-establishment of collaboration between the two nations. The atomic race would be easier to win in partnership with the United States. The result – the 1958 Nuclear Co-operation Agreement – was effectively the end of Britain's independent designs. The US Mark 28 was largely adopted for service by the British military, under the name of Blue Steel.

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