LEFT ***A section of Mark Postlethwaite's magnificent painting*** **Dambusters — The Opening Shots.** ***It depicts Wg Cdr Guy Gibson's Lancaster B.III (Special) ED932, AJ-G, delivering its*** **Upkeep** ***in the face of fierce anti-aircraft fire from the gun towers defending the Möhne dam, 30 miles (45km) east of Dortmund, during Operation*** **Chastise** ***on the night of May 16, 1943. © 2023***

A REVOLUTIONARY APPROACH

A TECHNICAL LOOK AT THE *UPKEEP* "BOUNCING BOMB"

Continuing our series on the history and development of Britain's aerial weapons, using technical illustrations by **IAN BOTT**, Barnes Wallis Foundation Trustee and author of *Bouncing-Bomb Man: The Science of Barnes Wallis* **IAIN R. MURRAY** looks at the nuts and bolts of this most famous of bombs — which was not technically a bomb at all . . .

ON MAY 17, 1943, as floodwaters poured down Germany's Möhne and Eder valleys, and the Avro Lancaster crews of the RAF's No 617 Sqn headed for home, the men could scarcely have imagined that 80 years later their exploits and the unique weapon they used would have become the stuff of legend. The "bouncing bomb" had been conceived in the mind of aeronautical engineer Barnes Wallis and delivered by a squadron specially formed for the challenging low-level mission.

THE BIG IDEA

At the beginning of the war Wallis was working at Vickers-Armstrongs and was already well-known as the designer of the R100 airship and the Wellington bomber, and he set himself the goal of using his skills to shorten the war. He realised that it was more efficient to destroy the sources of war production and power — coal mines, oil storage and especially dams — than to destroy the resulting weapons on the battlefield; however, the nature of these targets made them virtually impregnable.

Initially, he knew little about the properties of bombs, but he studied the topic in depth for himself and learned three key facts:

- it is the shockwave created by an explosion which causes the most damage;
- this shockwave travels better through earth and water than through air;
- the power of the shockwave is proportional to the cube of the weight of the explosive charge.

Taken together, these pointed to using the largest possible weight of charge, which had to be detonated underground. He settled on a weight of ten tons as the heaviest practical bomb that might be carried by an aircraft in the near future, and set about designing a bomb (and the aircraft to carry it) and examining the practicalities of dropping the bomb from great height to give it sufficient speed to bury itself into the ground, where the shockwave would create an earthquake effect.

These ideas were gathered in his *Note on a Method of Attacking the Axis Powers* of March 1941, which ran to more than 50 pages (plus numerous figures and appendices), a few dozen copies of which were secretly circulated to various ministry contacts. His proposals were rejected, but garnered sufficient interest for the formation of a committee to investigate methods of attacking dams and for preliminary experiments to be given approval.

Accordingly, scale-model dams were built at two civil engineering laboratories, at which explosives tests were undertaken. The latter showed that even the proposed ten-ton bomb exploding near the dam would not seriously damage it, owing to the dam reflecting the shockwave. A serendipitous experiment, however, found that only two tons of explosive could break a gravity dam — as long as the bomb was detonated in contact with the wall so that the shockwave would travel through the wall and blow out the masonry on the air side.

This effect was confirmed by test explosions on a disused dam in the Elan Valley in Wales during May–July 1942. The obvious solution was to use some sort of torpedo to run up the lake and into the dam, but it was known that many German dams were protected by anti-torpedo nets. Wallis then occupied himself with the problem of precise placement of a bomb under these constraints.

His earlier reading had included a German book on ballistics, which noted that a missile hitting water at an angle below 7° would bounce off the water rather than dig in and sink, so he set about some experiments on his own to see if he could reliably get objects (originally his children's