

WASC 2237  
Extract from  
Touchpaper  
September 2013  
on The  
Bouncing Bomb/  
Dambuster Raid  
Les Tucker

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# TOUCHPAPER

The Newsletter of the Royal Gunpowder Mills Friends Association

**Dambusters Raid 1943**

**Book Review - Company of Spears**

**More South Site History**

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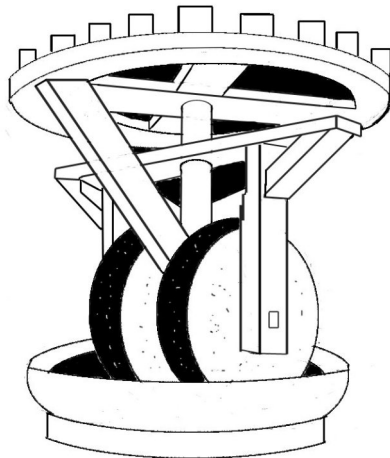
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# **Dambusters Raid 1943 - 70th. Anniversary**

## **The Bouncing Bomb ('Upkeep') and the RGPF Waltham Abbey Connection**

On 16th. May 1943 19 Lancaster bombers of 617 Squadron, led by Wing Commander Guy Gibson, took off from RAF Scampton in three waves on one of the boldest bombing actions of WW2 – Operation Chastise, employing the 'Bouncing Bomb'. The following outlines the story and the connection of RGPF Waltham Abbey with the bomb.

The objective was to breach the dams which held the reservoirs serving the vital Ruhr industrial area, inundating its factories and power stations. Three dams were targeted – Mohne, Eder, Sorpe.

The project originated in British military interest in finding a means of attacking targets such as the battleship Tirpitz, moored in a Norwegian fjord, and the dams holding the water for German hydroelectric schemes. In April 1942 Barnes Wallis, working for Vickers Armstrong, wrote a paper entitled 'Spherical Bomb – Surface Torpedo' describing a method of attack involving bouncing a bomb across the water at a target with the explosion occurring under water, taking advantage of the 'bubble pulse' effect of underwater explosions to increase explosive power. Strictly speaking the bomb did not bounce, it ricocheted – a technique to improve range in maritime warfare first postulated by Wm. Bourne, a master gunner in the reign of Elizabeth I.

At that time the subject was being examined by several governmental research organisations and it was decided to carry out test explosions. One of the organisations in the forefront of investigation at that time was the Road Research Laboratory at Harmondsworth and they set up a test, conducted by a RRL scientific officer Dr. A.R. Collins, involving the detonation of a naval mine against the face of a redundant dam at Nant-y-Gro in the Elan Valley in North Wales. Barnes Wallis attended as an observer. The result, in May 1942, was

spectacularly successful.<sup>(1)</sup>

Encouraged, Wallis pursued his plan, alongside his normal work. In the meantime development continued at the RRL and other centres but Wallis, partly by virtue of his position as designer of the necessary modifications to the Wellington bomber, which was selected as the vehicle for the first airborne test (Lancasters were used on the actual raid), gradually assumed the role of the driving



### **Result of test explosion at Nant-y-Gro dam**

force of the project. This continued to be in parallel with his normal duties and did not attract unqualified support. At one point he was hauled up in front of his boss, the CEO of Vickers, given a severe ticking off and told ‘to stop making a nuisance of himself’.

Legend has it that Wallis, in the finest British backroom tradition, started his first experiments in his garden with marbles and a tin bath. He obtained permission to use the test facilities of the National Physical Laboratory and there he pursued the idea of imparting back spin to the bomb, as in driven golf balls. This increased the ability to bounce, improved height and stability of flight and ensured that when it hit the dam face it would then bounce away but the

remaining back spin would draw it back to where it would sink as near as possible to the face<sup>(2)</sup>.

In August 1942 he convinced the Ministry of Aircraft Production that the idea was feasible and justified trials from aircraft and in November 1942 approval was given for the manufacture of test examples of a bomb designed for use against dams, code name 'Upkeep' later termed the Bouncing Bomb, to be manufactured by Vickers, Type No. 464. The first trial, using a concrete filled bomb, was carried out in December 1942 on the Fleet Lagoon at Chesil Beach, Dorset, where there was a long lagoon between the land and a shingle bank stretching to Portland, in a Wellington bomber flown by Captain Matt Summers, chief test pilot of Vickers. Testing was a hazardous undertaking. A later test drop programme of the naval version of Upkeep by the Americans in 1945 was abandoned after the bomb bounced back on the aircraft causing it to crash with the loss of the pilot. There was one fatality at the Chesil Beach.

Originally Upkeep comprised an inner cylinder filled with explosive and an outer spherical case. It was found that the outer cases were shattering on impact and they were abandoned, with the cylinder remaining. (It has been reported that in the film *The Dam Busters*, made in 1955, the bomb depicted was shown as spherical, not the final cylindrical. Apparently this was done at the insistence of the Authorities, for security reasons).

Not surprisingly many subsidiary problems were encountered, e.g. there was no bomb trolley existing which could carry Upkeep, a special one had to be made. It was not possible to move it into the bomb cradle by the normal method underneath, instead the tail of the aircraft was lifted by crane and the bomb wheeled in from behind. It was found that the weight of metal involved was affecting the compass of the aircraft. This was countered by employing two compass deviation cards, one for flying without the bomb and one for



## **Bouncing Bomb**

when flying loaded. Denting of the casing on impact was a problem – the dents could affect the underwater dynamics. This was countered by the use of a phenolic resin expanded into a foam.

Critical to success was maintenance of the correct spinning speed. The bomb was given a backspin at 500rpm 10 minutes before release. Originally the intention was to use a Ford V8 engine but this was later replaced by a Vickers Jassey hydraulic motor, powered by the hydraulic system of the upper gun turret, which had been removed, with the speed of rotation monitored on a rev counter and controlled by a valve linked to a gear box and a pulley which drove a rubber belt which spun the bomb via a pulley. The crew member deputed to this control function was the wireless operator, presumably because he would be free on the run in. To counter vibration each bomb was balanced on a test rig in the same way as car wheels with small weights fitted on the ends of the casing until it span without vibration. It was held in place by two spring loaded calipers which were flipped open allowing it to drop.

To trigger explosion there were three fuze pockets containing

hydrostatic pistols. These operated by water pressure and when the bomb reached a certain depth they triggered an initiating explosion which triggered the main explosion – similar to the system in naval depth charges. There was also a self destruct celluloid / acid delay time fuze similar to that on aerial bombs.

Aiming was via a pair of intersecting spotlight beams and a hand held device. This proved awkward and some crews resorted to a chinagraph and string!

By February 1943 the trials and necessary improvements had progressed to the extent that Wallis could claim that the bomb was a practical proposition. The scheme encountered considerable scepticism. A special presentation was made to Air Chief Marshal Arthur ‘Bomber’ Harris. Harris returned the subsequent write up with the hand written comment - ‘This is tripe of the wildest description. There are so many if and buts and there is not the smallest chance of it working’. However by this time the ultimate arbiter, the Air Ministry, had decided that the project should go ahead. The time given to make all preparations for modification to



**Guy Gibson and Lancaster aircrew**

aircraft, obtaining equipment, crew training etc. was extremely short – the latest the drop could be made was May, after that the estimated water level in the dams would be seasonally lower, reducing the effectiveness of the bomb.

Wing Commander Guy Gibson DFC, aged 24, was appointed to lead the mission and he began an intensive period of crew selection and training, including practice flights over the Derwent reservoir dam in Derbyshire. Projected flying heights – 100 feet on the journey – to dodge anti-aircraft fire and night fighters, and 60 feet, the height of a medium size tree, on the approach to the dams were regarded by some as suicide.

By this time it had been determined that the only aircraft capable of carrying the weight and dimension of Upkeep was the Avro Lancaster. The Lancaster was designed to fly at an operational height of 10,000 feet and substantial modifications were required to enable flying at these lower levels. As Gibson said of the 60 feet - ‘At that height you would only have to hiccup and you would be in the drink’.

## **The Waltham Abbey Connection**

Although little mentioned in accounts, the explosive filling of the bomb was of crucial importance. It was found that an explosive composition named Torpex, originally developed for torpedo warheads, providing a longer explosive pulse for greater effect on underwater targets, was eminently suitable. Torpex comprised 42% RDX, 40% TNT and 18% aluminium powder. The total weight of the bomb was 9250lbs. and the explosive filling 6600lbs. RDX was an extremely powerful explosive and the practice was normally to use it in conjunction with TNT. Aluminium powder was added to increase energetic performance.

Both the two main elements of Torpex and development of the product were closely linked to the Royal Gunpowder Factory at Waltham Abbey.



RDX was a crucial explosive of WW2. After initial development of a manufacturing method by the Armament Research Department at Woolwich the Royal Gunpowder Factory at Waltham Abbey had taken on the vital function of establishing, early in 1939, and operating a pilot plant. This would enable ironing out any problems, engineering the design and gaining the experience of a system which would enable production on an industrial scale at a new Ordnance Factory being built at Bridgwater, Somerset. Events were moving very quickly. By the time war was declared in 1939 Bridgwater was still being built and was not, in fact, ready for production until August 1941. Over the first two years of the War therefore the Waltham Abbey RDX plant, which was intended as a small scale pilot plant, was pitchforked into the role of sole supplier of RDX to the Forces and it is to its considerable credit and the staff that it successfully fulfilled this role.

The development of TNT followed a similar pattern. Although TNT had been used in WW1 there were doubts as to the use of the manufacturing process employed. Development staff at Waltham Abbey produced a plan for a vastly improved continuous nitration process which was successfully tested in a pilot plant erected at Waltham Abbey in 1939 and provided the template for TNT production at the new ordnance factories which were built.

Having played a crucial role in establishing manufacturing processes, the underwater facility at Newtons Pool to the north of the gunpowder factory was then used extensively for testing.

## **Catalin**

The connection of Waltham Abbey with the Bouncing Bomb did not end with Torpex. The use of an expanded phenolic resin foam to protect against denting has been mentioned above. This was a proprietary product termed Catalex, made by Catalin Ltd.

Catalin were the UK offshoot of the Catalin Corporation of America, resin manufacturers, established here in 1937 on the site in Farm Hill Road previously occupied by Joyce & Co. manufacturers of percussion caps for small arms ammunition.

The details of the outcome of the mission are well known.

The first wave, of nine Lancasters, led by Gibson, in the face of fierce anti-aircraft fire successfully breached Mohne, releasing a torrent of water.

Similar success was achieved with Eder.

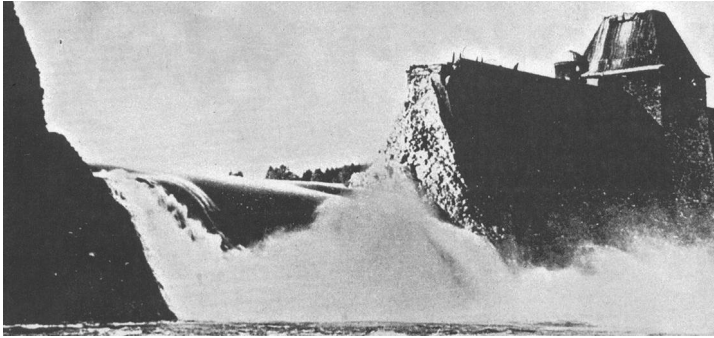
Gibson's bomb, at Mohne, the first to be dropped, failed to reach its target, but he then took on the highly dangerous task of circling to direct subsequent attacks and draw anti-aircraft fire away from those making their bombing runs.

The attack on Sorpe was less successful, damaging but not destroying it. Large waves were generated and one of the Lancasters was flying so low that it lost its bomb to the spout created by the previous aircraft.

Not surprisingly there was a huge sigh of relief when a bomb was successfully released and the Lancaster involved could turn for home.

Navigators were required to maintain flight logs. The log of Flight Sergeant Vivian Nicholson,<sup>20</sup> navigator on the Lancaster AJ-J 'Johnny' piloted by Flight Lt. David Maltby, has recently come to light. This aircraft was in Gibson's first wave and Nicholson was on his first bombing mission. Although the logs were obviously meant to be written in correct official language, he couldn't resist a note of youthful exuberance in the General Observations column of the log.

One of his first entries reads 'Chocks away' and revealingly when



## **Mohne breach**

their bomb is dropped ‘Bomb dropped – Wizard’.

His navigation system was jammed by enemy counter measures and Maltby had to take violent evasive action to avoid anti-aircraft fire – this in a plane designed to lumber along at 10,000 feet.

Maltby was in fact to play a vital role at Mohne. After damage had been caused by previous bombs but not a breach Gibson ordered Maltby to attack and his bomb successfully caused the breach. Having dropped his bomb, at 49 minutes past midnight, Maltby brought his unscathed Lancaster back to RAF Scampton at just after 3 in the morning of 17th. May 1943.

As always, there was a price to pay. Eight of the Lancasters out of the original 19 did not return. Of the total 133 aircrew 53 men of 617 Squadron lost their lives and three were taken prisoner.

Gibson was decorated with the Victoria Cross and in total 33 of the surviving Dambusters received honours.



A copy version 'Emil' was built and tested at the Luftwaffe test site at Travemunde on the Baltic. Again a hazardous operation. The importance of back spin had not been grasped and the pilot of the test plane had the disconcerting experience of seeing the bomb match the speed at which it was dropped. The project was discontinued in 1944.

The implications of the crash and the realisation that a bomb might have been recovered intact caused considerable perturbation in Britain and as a result anti-aircraft defences at all British dams were considerably strengthened.

For his action, and previous bomb disposal work, Heinz Schweitzer was awarded the Knight's Cross of the Iron Cross. At considerable risk to himself he later saved a large numbers of prisoners from being shot by the SS.

Debate still continues as to the strategic significance of the damage caused by the raid. Some opinion has it that it wasn't quite as much as Wallis might have claimed – the ability of German industry to recover after apparently catastrophic damage was not fully appreciated until after the war's end.

However public morale was an important part of total war and the Dambusters Raid was undoubtedly an important boost to public morale in the dark days of 1943.

In a spirit of reconciliation, and with the agreement of the farmer who owns the field, a local police officer has placed a plaque at the site of the crash of AJ-Easy. It is hoped that it will be replaced by an official plaque.

(1) History has not been too kind to Collins and the contribution made by other prominent members of the Road Research Laboratory and other research organisations. In a paper read in 1982 he said that the importance of the role played by Sir William Glanville, Dr. G. Charlesworth and others had been overlooked and implied the role of Barnes Wallis had been overplayed to that extent. However the fact remains that the man who ultimately drove the project through to completion was Barnes Wallis.

(2) Again the edges of history become blurred. Barnes Wallis is credited with introduction of the idea of back spin. However also in 1982 in a lecture delivered by Sir George Edwards, former chairman of British Aircraft Corporation, he said that in fact he had persuaded Wallis to employ the idea.

## **Post Script**

1. In New Zealand at the Museum of Transport and Technology there is a mechanical differential analyser analogue computer. It is alleged that this was used in the design of Upkeep. Can the computer experts say anything on this?

2. National memorials have high maintenance costs. The maintenance bill from Westminster Council for the Bomber Command memorial, opened by the Queen last year, is £1.5 million. To meet this an appeal has been launched, under the aegis of a club, patron Dame Judi Dench. Someone has neatly made the connection between the alternative name for maintenance – upkeep and the bomb employed in the raid and has named the club the Upkeep Club.

Les Tucker