Annex 1

List Entry

List Entry Summary
This building is listed under the Planning (Listed Buildings and Conservation Areas) Act 1990 as amended for its special architectural or historic interest.

Name: No. 2 Cavitation Tunnel (Buildings 46 & 47), Haslar Road, Gosport

List Entry Number: 1413978

Location
Buildings 46 & 47, QinetiQ, Haslar Marine Technology Park, Haslar Road, Gosport, Hants, PO12 2AG

The building may lie within the boundary of more than one authority.

County	District	District Type	Parish
Hampshire	Gosport	District Authority	Non Civil Parish

National Park: Not applicable to this List entry.

Grade: II

Date first listed:
Date of most recent amendment:

Legacy System Information
The contents of this record have been generated from a legacy data system.

Legacy System: Not applicable to this List entry.
Legacy Number: Not applicable to this List entry.

Asset Groupings
This List entry does not comprise part of an Asset Grouping. Asset Groupings are not part of the official record but are added later for information.

List Entry Description

Summary of Building
No. 2 Cavitation Tunnel, designed and built in Germany in the early 1940s and brought to Haslar after the Second World War, also Buildings 46 & 47 of 1950s date constructed to house the tunnel and associated machinery and plant.

Reasons for Designation
Buildings 46 & 47, including the No. 2 Cavitation Tunnel, are listed at Grade II for the following principal reasons:
* Technological interest and origins: No. 2 Cavitation Tunnel was designed and built by a leading German scientist and major ship-building company for a highly significant Hamburg research establishment. The

importance of the tunnel was such that it was brought to Haslar after the Second World War and housed within purpose-designed paired buildings by the Admiralty Experimental Works;
* Rarity and intactness: one of only two cavitation tunnels in the United Kingdom. The other, the Emerson Tunnel at the University of Newcastle, was not originally built for cavitation testing and is a composite;
* Significance to British vessel design: the tunnel is understood to have contributed to the design of every vessel for the British Armed Forces while it was operational;
* Architectural interest: the tunnel and its associated machinery and plant are housed within two purpose-designed and built early 1950s buildings whose function is legible through form.

History

The No. 2 Cavitation Tunnel was designed and built in Germany in the early 1940s but was subsequently brought to England at the end of the war and installed on the Haslar site, formerly known as the Admiralty Experimental Works (AEW). This was established in the 1880s to conduct ship model research following the closure of AEW Torquay. The main development of the Haslar site was in the decade from 1945.

Cavitation is the sudden formation and collapse of bubbles in a fluid through mechanical forces, such as those caused by a propeller in water. A cavitation tunnel is therefore used for testing scale model propellers and hulls in order to consider the impacts on propulsion, wake, vibration and noise: cavitation causes underwater noise and minimising or eliminating this is an important component of submarine design, for example. Cavitation also has an erosive effect on propellers and thus on efficiency. A cavitation tunnel is similar in function to a wind tunnel but here water filled.

No. 2 Cavitation Tunnel was designed by Dr Herman Lerbs, a leading German cavitation and propeller research and experimentation scientist. It was built by the firm Blohm and Voss of Hamburg, an important German company set up by Herman Blohm and Ernst Bloss who were shipbuilding engineers. The company built the battleship Bismark among others, U-Boats and also aircraft. The client was the Hamburgische Schiffbau-Versuchsanstalt (the Hamburg Ship-building Research Centre). Lerbs began to build the tunnel in late 1939. It was photographed in 1941 during its installation in Hamburg (Weitendorf 2001, 4) and completed in 1943 but was damaged the same year by enemy bombing, the site undoubtedly a key target for the Allies. Repairs were still being made, although almost complete, when the war ended in 1945.

In 1947 No. 2 Cavitation Tunnel was brought by the Admiralty from Germany to Haslar, Gosport as part of the war reparations programme. Its re-erection was begun in 1947 and completed in 1949 (Newton 1962, 361). A building to house the tunnel was designed in August 1951 (drawing reference E344/51 by the 'Civil Engineer-in-Chief's Department Admiralty Fareham District' for the Cavitation Tunnel Building No. 2 - now known as Building 47 - dated 30th August) with construction beginning in 1952. The design and as-built form differ slightly such as the addition of 'turrets' on the south-east elevation. A date stone of 1955 over the main pedestrian entrance is taken to signify the completion date. Tests are understood to have commenced in 1957 with the tunnel fully operational in January of the following year and have included tests relating to both submarine and destroyer design (Newton 1961, 383). The facility's research is understood to have been responsible for the design of every vessel (both ship and submarine) built for the British Armed Forces since the tunnel was operational here. The underwater hydrodynamics of weaponry is also understood to have been studied here. The site, now operated by QinetiQ, continues research and testing for ship ad submarine builders including the Royal Navy.

According to Newton (1962) although it was originally intended to rebuild and operate the tunnel as in Germany, some modifications and improvements were made. These included the addition of a centralised control system to allow remote operation, modern speed control, enlargement of some observation windows and the addition of two top hatches to insert models, separate water de-aerating equipment (accommodated in a separate building – Building 46) and an auxiliary plant room. Therefore the tunnel shell, impeller and model propeller drives are essentially original German fabric although electrical circuitry for example has been modernised. The No. 2 Cavitation Tunnel was operational until circa 2008 testing primarily propellers for submarines and other vessels including warships and minor craft.

The world's first cavitation tunnel was built by Sir Charles Algernon Parsons in Newcastle in 1895. This was of very small size (model-like) and is not believed to survive. His second tunnel of 1910 was on a larger industrial scale (demolished). It was from the 1930s that cavitation tunnels began to be built in any numbers internationally with about ten in the world by 1942 (Rolls Royce website) and 63 operational in 1995 (catalogue by the International Towing Tank conference); of these approximately five were of pre-1950 vintage. There are currently two cavitation tunnels in the United Kingdom, No. 2 Cavitation Tunnel in Gosport and the Emerson Tunnel (formerly known as the King's College Cavitation Tunnel), University of Newcastle-upon-Tyne, also brought from Germany after the war (from Pelzerhaken) and operational in 1950.

A further cavitation tunnel at Haslar, the No. 1 Cavitation Tunnel, smaller in scale than No. 2, completed in 1941 and therefore operational during the war, is understood to have been housed in a building immediately south-east of No. 2 Cavitation Building but was demolished in 1993.

Details

The site under assessment includes two adjoining buildings, both with a rectangular footprint. Building 46 is the smaller of the two and is located to the immediate south-west of Building 47 (which contains the No. 2 Cavitation Tunnel and some ancillary accommodation). Building 46 houses water tanks for the tunnel. Both buildings are oriented north-west to south-east.

EXTERIOR

The buildings are of steel-frame construction and encased in English bond red brick. Both have flat roofs. Window and door surrounds are of concrete. Building 46 retains its original steel-framed windows; those to 47 have been replaced with modern units (circa 1990s) although within original openings.

BUILDING 46 has a pedestrian access door and single first floor window in its north-west elevation. Its north-east elevation is blind. Here an enclosed angled bridge joins Buildings 46 and 47 at first and second floors respectively with a pipe run beneath the bridge. The south-east elevation has one blocked opening to the west and a pair of part glazed double-doors: these are elevated above ground level and there are no steps providing access. The south-west elevation has six elongated windows covering both floors arranged 1:1: 2: 1: 1. These retain their nine-over-nine steel-framed casement windows. A concrete plat band delineates the roof line which is hidden behind a parapet.

The principal elevation of BUILDING 47 is to the north-east and is of seven bays, the end bays elevated about the roof line in a turret-like manner. Windows are again elongated across all floors except the southernmost bay which is foreshortened, stopping at the first floor. The central bay is differently treated having triple lights above a large machine-bay door which is a wooden folding arrangement with glazed upper lights. To the north is a pedestrian door (a modern unit inserted into an original opening). This has a large projecting concrete rain hood above which is a decorative date-stone with an anchor and rope and the date 1955. Rainwater goods have been replaced in plastic. The north-west elevation has a replacement modern roller shutter door in an original opening, above which is a beam for lifting machinery in and out of the building. A triple arrangement of elongated windows lights the interior stair. The south-west elevation is of seven bays with elongated windows. Grilles and a fire-escape to the south are later additions. The south-east elevation is in two parts: to the west are three elongated windows, the middle wider than the outer examples. The middle window is interrupted at first floor level where a patch of brickwork indicates a former connecting doorway to the No 1 Cavitation Tunnel Building which used to stand to the south of that for No 2. To the east is a pair of elongated windows to the first and second floor and a folding part glazed door as on the north-east elevation. There are a number of mobile phone masts fixed to the roof of this building.

INTERIORS

BUILDING 47 has a staircase wrapping around a lift shaft in its north corner. The wooden hand-rail is original. The south-west side of the building is occupied by the Cavitation Tunnel, this side of the building having two floors. The north-east side of the building houses ancillary accommodation over three floors: a large maintenance room to the ground floor; offices, WCs, a kitchenette and a possible drawing office to the upper floors. The office spaces are simply arranged and decorated: structural piers and roof girders are evident, there are also simple wooden doors with glazed lights (either rectangular or diamond shaped). Some doors retain their Bakelite fittings.

The cavitation tunnel occupies the whole of the south-western part of the building and is accessed from the north-east of the building at ground and second floor level.

The ground floor cavitation tunnel room has a series of grilles in the floor along the north-east side of the room allowing easy access to services. There is a large full-height pair of timber double doors connecting the maintenance room and the cavitation tunnel room, also a large trap door in the ceiling at the north-west end allowing equipment to be lifted through the external doors and up to the upper floor. On the upper floor is a gantry crane running the length of the cavitation room. This is understood to be a replacement of perhaps 1970s or 1980s date. There are also switch cabinets and an illuminated control panel along the north-east wall.

CAVITATION TUNNEL

The tunnel is described in Gawn (1955, 21-2) with a detailed specification recorded by Newton (1962) including its principal dimensions and a schematic drawing. In summary the tunnel consists of a vertically mounted asymmetrical but broadly ovular tube, the whole mounted on two large pedestals. The tunnel is made up of eleven welded mild steel plate sections with heavy steel joint flanges. Two of the bends are of cast iron. The interior of the tunnel is understood to be zinc sprayed and painted. To the north-west are the motors with drive shafts entering the horizontal tubes, one at ground floor level (the impeller motor which circulates the water through the tunnel) and one (the model drive or propeller motor to drive the propeller under test) at the upper level on the second floor. The dimensions of the whole are approximately 63 feet (19.2m) in length and 40 feet (12.19m) tall. The sectional dimensions at the test section (within the uppermost horizontal tube) are 7.8ft wide (2.38m) x 3.9ft tall (1.19m) which, in 1962, was the largest in the world. At ground floor level there is a pit underneath the tunnel allowing access to services; also rollers for expansion and flex at the south-east end of the tunnel. At upper level are the observation windows which are made of toughened glass. These are located both in the sides and top of the tunnel. (There is also a spare solid top panel for use when top observation was not required.) The comprehensive control panel is located on the upper floor as is the experimenter’s console, located adjacent to the model drive motor.

BUILDING 46 can be accessed at both ground floor level and via a narrow pedestrian staircase encased in a brick bridge which leads down from the upper floor of Building 47. This building is almost entirely filled with three large tanks containing water. Inlet and outlet pipes are colour-coded with red for water and yellow for pressurised air (to force the water between the tanks and the Cavitation Tunnel). The concrete beam roof is exposed and there are two metal grill floors creating a mezzanine at ‘first floor’ level and a part-raised plant floor at ground level. A ladder in the west of the building enables access between the two. On the mezzanine to the south-east are racks for storing propeller shafts for testing.

Selected Sources

Gawn, R W L, The Admiralty Experiment Works, Haslar, Quarterly Transactions of the Royal Institution of Naval Architects, Vol. Vol. 97, No. 1, January 1955, 1955

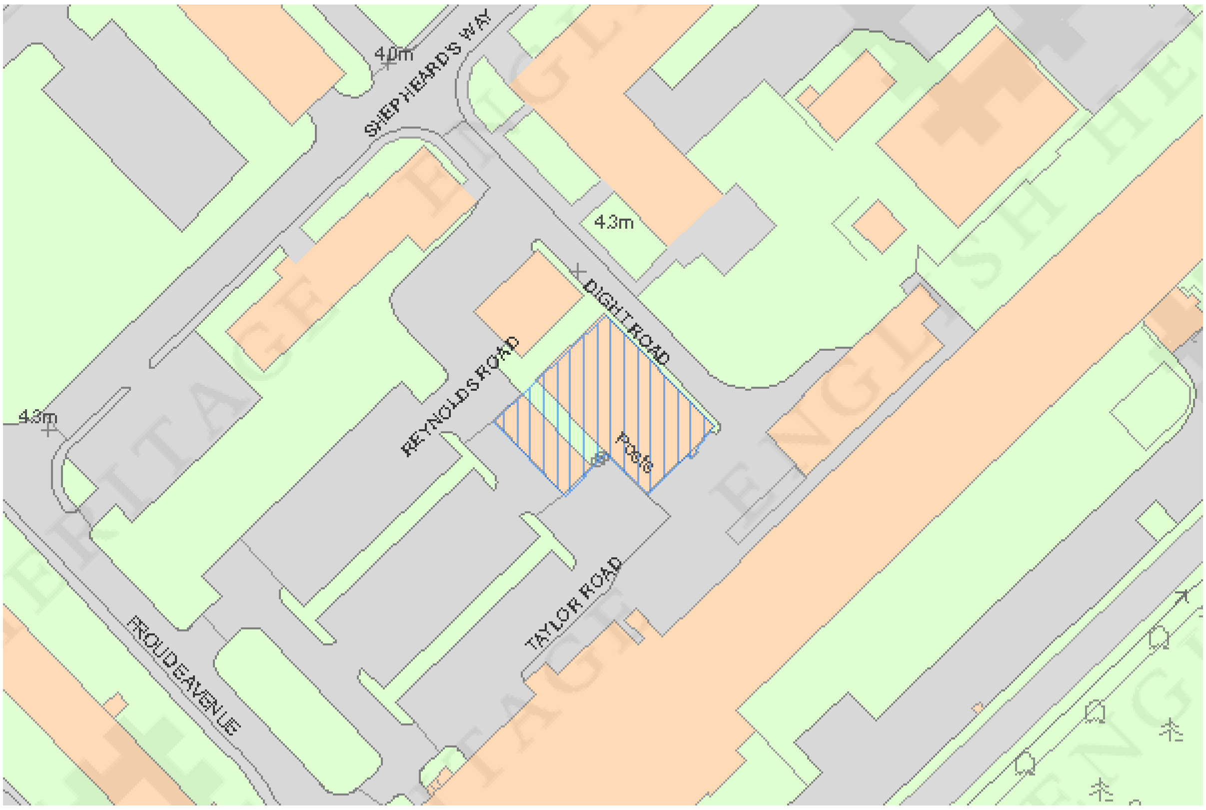
Newton, R N, New Facilities at Admiralty Experiment Works, Haslar, Quarterly Transactions of the Royal Institution of Naval Architects, 1962

Rolls-Royce, Rolls-Royce Hydronamic Research Centre – 40 Years, www.rolls-royce.com, 18 February 2013

Weitendorf, E–A, On the History of Propeller Cavitation and Cavitation Tunnels, caltechconf.library.caltech.edu/85/1/cav2001_sessionB9.001a.pdf, 31st January 2013

Map

National Grid Reference: SZ6142198744



The above map is for quick reference purposes only and may not be to scale. For a copy of the full scale map, please see the attached PDF - 1413978_1.pdf