Manoeuvring Tank (now known as Ocean Basin), Haslar Marine Technology Park (Former Admiralty Experiment Works)

Official list entry

Heritage Category: Listed Building

Grade: II

List Entry Number: 1479230

Date first listed: 26-Aug-2022

Statutory Address 1: Haslar Marine Technology Park, Haslar Road, Gosport, Hampshire, PO12 2AG

For these purposes, to be included within the curtilage of the building, the object or structure must have formed part of the land since before 1st July 1948.

Understanding list entries *(https://historicengland.org.uk/listing/the-list/understanding-list-entries/)*

Corrections and minor amendments *(https://historicengland.org.uk/listing/the-list/minor-amendments/)*

Location

Statutory Address: Haslar Marine Technology Park, Haslar Road, Gosport, Hampshire, PO12 2AG

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

County: Hampshire

District: Gosport (District Authority)

Parish: Non Civil Parish

National Grid Reference: SZ6152998971

Summary

A large covered ship model manoeuvring tank, now known as Ocean Basin, constructed by Messrs Trollope and Colls at the Admiralty Experiment Works (AEW) Haslar between 1955 and 1959.

Reasons for Designation

The Manoeuvring Tank, built in 1955 to 1959 at the former Admiralty Experiment Works (AEW) Haslar, is listed at Grade II for the following principal reasons:

Historic interest:

* as an innovative example of an mid-C20 ship model testing tank and research facility, designed specifically to facilitate a far greater range of experiments in controlled conditions; * for its considerable influence in the field of international hydronamic research; * for its significant contribution to the development of the Royal Navy's surface and submarine fleets in the post-war age of fast-paced naval warfare.

Architectural interest:

* as a ship model testing building that survives well, retaining much of its original external industrial character and most of the internal plan form, comprising the huge testing tank, docks, and surrounding ancillary rooms; * for its ambitious scale and innovative design, particularly the reinforced concrete tank and the single-span roof structure; * as one of the largest hydrodynamic testing buildings in the world.

History

The former Admiralty Experiment Works (AEW) Haslar is situated on the northern side of Haslar Peninsular, to the west of Portsmouth Harbour. Prior to its establishment in 1886 the site had been remote and relatively inaccessible. Since its construction and throughout its expansion in the C20, AEW Haslar has been a site of national and international significance for its scientific contributions to the empirical study and development of ship hulls and propulsion systems. This has had a profound impact on the development of many vessels in the Royal Navy surface and submarine fleets and on commercial high-performance craft used to set world water speed records. Experiments undertaken at AEW Haslar directly influenced the design of every class of warship operated by the Royal Navy in the late C19 and C20.

Sites devoted to the empirical study of ship hull performance and propulsion systems in England date from 1870, when pioneering engineer William Froude (1810-1879) constructed the first experimental tank for model ships adjacent to his home in Torquay. Having begun to conduct water resistance experiments on ships in the 1850s, Froude attracted the attention of the Admiralty by demonstrating that it was possible to obtain accurate ship hull resistance data from model tests. In 1868 the Admiralty granted Froude £2000 for the construction of a test tank to undertake rolling and resistance tests at Torquay. The site became known as the Admiralty Experiment Works (Torquay) from 1872. William Froude’s third son, Robert Edmund Froude, continued the programme of experimentation after his father’s death in 1879, and in 1882 he was invited to design a new facility to replace the Torquay tank. After considering a number of potential sites in the 1880s the AEW settled on Haslar due to the sufficient open space it provided for R E Froude’s new ship tank design and its proximity to other naval facilities including a gunboat yard, Royal Hospital, and a Royal Naval cemetery. Following the closure of AEW Torquay, new facilities began to be established at Haslar from February 1886. The first experiments measuring the effects of water resistance on model ship hulls were conducted in the newly-constructed Number 1 Ship Tank in 1887.

The Naval Defence Act of 1889 saw a huge increase in the Royal Navy’s shipbuilding programme, and the testing facilities at AEW Haslar had a huge impact on the hull designs of the expanding British surface fleet in the period leading up to the First World War. By 1918 more than five hundred different warship models had been tested at Haslar. A 1917 plan shows a number of temporary huts built along the shoreline of Haslar Lake to provide accommodation for military personnel during the war. Most of these temporary structures remained on site until after the Second World War when they were gradually removed to make way for new test facilities.

The development of both the surface and submarine fleets in the First World War necessitated the expansion of test facilities at AEW Haslar. By 1927 plans for a second, larger ship tank had been drawn up; Number 2 Ship Tank was completed in 1930. In the 1930s AEW expanded into testing for the private sector, most notably for Sir Malcolm Campbell's Bluebird K3 and Bluebird K4 craft, in which he broke the world water speed records in 1936 and 1939 respectively. Both craft were extensively model tested in Number 2 Ship Tank. Plans to construct new facilities for propeller research began in 1937. The first of these new buildings, Number 1 Cavitation Tunnel, was completed in 1941. Cavitation is the sudden formation and collapse of bubbles, which can be caused by a propeller in water. This water-filled tunnel was therefore used for testing the efficiency of model propellers and hulls in relation to propulsion, wake, vibration and/or noise. A much larger cavitation tunnel was constructed in Hamburg during the Second World War. Following the end of the war, the Royal Navy shipped the German tunnel to Haslar and reassembled it between 1947 and 1949. Post-war financial restrictions prevented construction of the building to house the new No 2 Cavitation Tunnel until 1952, and the tunnel was not fully operational until 1958. Number 2 Cavitation Tunnel was listed Grade II in 2013.

The post-war period saw considerable expansion of the test facilities at Haslar, as the AEW realised that a far greater range of experimentation was required to improve the manoeuvrability of ships in response to the fast-paced naval warfare of the Second World War. Several ancillary facilities were constructed between 1945 and 1960 including a propeller laboratory and a photography laboratory. Number 1 Ship Tank was extended between 1956 and 1957 according to a planned extension in R E Froude's original design. Steering and manoeuvring experiments began on nearby Horsea Lake in the 1950s and a large covered Manoeuvring Tank was completed at Haslar in 1959.

Operations at Haslar began to be streamlined in response to the amalgamation of AEW into the Admiralty Marine Technology Establishment (AMTE) 1977-1984, the Admiralty Research Establishment (ARE) 1984-1991, and ultimately the newly-formed Defence Research Agency (DRA) in 1991. Number 1 Ship Tank was converted to offices in 1993. Several Post-War buildings and Number 1 Cavitation Tunnel were demolished between 1993 and 1995 to make way for new buildings and car parks. DRA became part of the Defence Evaluation and Research Agency (DERA) in 1995. In 2001 QinetiQ was split from DERA and has continued experimental research at the site since then.

The Manoeuvring Tank at AEW Haslar, which became not only the largest building on the site but also one of the largest hydrodynamic testing facilities in the world, was constructed between 1955 and 1959. The enormous steel roof span of the building is thought to have been the largest in the country for some 50 years prior to the construction of Heathrow Terminal 5 from 2002 to 2008. The Second World War had demonstrated that naval warfare required the rapid manoeuvrability of ships as well as increased submerged speed of submarine vessels, which called for far more ambitious testing than could be achieved within the narrow confines of the existing ship tanks at Haslar. After the war AEW began to use the non-tidal waterway at nearby Horsea Lake for steering tests using model ships, but inconsistent data arising from the uncovered nature of the lake led the Admiralty to approve in 1953 plans drawn up in 1942 for a large covered testing tank at Haslar. The new Manoeuvring Tank would enable model testing on steering and other manoeuvres with the simulation of both calm waters and waves generated by two banks of five plungers with a range of frequencies. A large rotating arm mounted on a central concrete island also allowed for the rigging and dynamic testing of submarine models. A site was selected in the northeast of the Haslar site adjacent to the gunboat yard slips and formerly occupied by allotment gardens. Following levelling of the site by Messrs A E Farr Ltd in February 1954 and excavation of the tank by G Wimpey and Co Ltd in August 1954, construction of the tank was divided into three phases and carried out by Messrs Trollope and Colls from May 1955. The first phase saw the construction of the tank floor and walls and the rotating arm base and piling, the second phase consisted of filling the tank with water to test its integrity, and the final phase saw the construction of the building around the tank. The tank was scheduled to be fully operational by 1959 but the first model tests were carried out in 1956 during the second phase. It took two weeks to fill the tank with 10,000,000 gallons of fresh water, and as the existing water supply was insufficient a new pipe had to be laid across Haslar Creek to Gosport. The total cost of construction, excluding the associated testing machinery, was £700,000. The tank was officially opened by the Duke of Edinburgh on 18 December 1961 during which he performed the customary “blessing” of the tank with a few drops from a flask of water retained from William Froude’s original tank at AEW Torquay.

The original design of the tank, to be flexible when settling under the weight of the water it contained, proved to be effective in preventing any serious cracks from forming in the sides of the tank, but soon after the second phase sumps had to be added around the perimeter to pump out rising ground water. The first few years of the tank’s operation also saw problems with the waves formed by the wave generator crashing over the gate to the dry dock used for rigging submarine models, creating a hazard for engineers working in the dry dock. In 1962, a pneumatic breakwater which discharged compressed air was added to the dry dock entrance to reduce the force of the waves at the gate. The wave generators were refitted in 1980 and underwent further major upgrades in 2014, when all the generators were located along the north-east side of the tank having previously been split across the north-west and north-east sides. Many of the original metal-framed windows have been replaced with modern uPVC units and some additional window openings have been created. Use of the Manoeuvring Tank for testing has continued under QinetiQ since 2001, although it is now known as the Ocean Basin.

Details

A large covered model ship manoeuvring tank, now known as Ocean Basin, constructed by Messrs Trollope and Colls between 1955 and 1959.

MATERIALS: a reinforced concrete tank housed in a two-storey building of ribbed aluminium ‘Q’ deck panelling backed by light steel sheeting to form a cavity filled with wool insulation; a pitched roof of corrugated steel sheets carried on tubular steel trusses; ancillary buildings of local red brick laid in stretcher bond.

PLAN: the building is rectangular on plan and oriented on a south-west to north-east axis. One and two storey ancillary buildings of brick wrap around the main building on all four sides.

EXTERIOR: the principal two-storey building has a pitched roof covered with corrugated steel sheets, which was repaired in the early C21. Two rows of rectangular skylights to each roof slope permit light into the tank below. The two gable ends of the building and upper parts of the side walls are constructed from ribbed aluminium panelling. Peripheral, ancillary buildings of one and two storeys with flat roofs and cavity brick construction wrap around the principal building on all four sides and contain offices and storerooms. At the north-eastern half of the building these ancillary buildings are two storeys high, rising to near the roofline. Fenestration to the south-east and north-west elevations of the principal building and all four elevations of the peripheral buildings mainly consists of five-pane uPVC casement windows, each with a tall pane in the centre and two smaller panes to each side, but other uPVC window arrangements and original metal-framed windows feature in places. The windows to the brick buildings have sills and lintels of concrete, and on the upper level these project out from the brickwork and connect with vertical members to create a continuous concrete frame around pairs of windows. Vertical shutters to the north-east and north-west elevations provide access to ground-floor workshops and storage spaces. Some ground-floor windows and shutters to the south-east and north-east elevations have been bricked up. The principal, south-west elevation has the peripheral brick buildings to the ground floor with the blind gable end of the principal metal building rising up behind. The flat roof of the ancillary range is punctuated with eight skylights which light the model preparation rooms below. This range is fenestrated with groups of five-pane windows to the ground floor with corresponding rows of smaller, three-pane windows above to light the mezzanine level. The wide, central bay of this elevation is pushed forward slightly and has red brick laid in Flemish bond. A projecting canopy of concrete surrounds the shuttered entrance to the test tank. Above the canopy there is a plaque with an anchor carved in relief and the date 1958. Above this, the brickwork rises in a series of steps supporting an aluminium panelled clerestory with a glazed front and a shallow-pitched roof. This replaced the original flat-roofed clerestory, which was constructed from brick and was lit from each side by three groups of three-pane windows.

INTERIOR: the interior space is dominated by a rectangular test tank of sectional reinforced concrete, which measures 122m by 61m. The tank is surrounded by walkways with metal railings that make up the first floor of the building. Around 1.5m of the tank's 5.5m depth is sunk below ground level. When full the tank holds 40,000 tonnes of water making it one of the largest hydrodynamic testing facilities in the world. The tank was constructed with expansion joints to address issues of settling and movement caused by the tank’s proximity to the high water line. The tank floor was also designed to allow for settling and movement, consisting of two layers of reinforced concrete laid in a large grid pattern and separated by a layer of bituminous felt, abutting the heels of the walls. The walls of the tank have various bay lengths and different buttress designs with expansion joints between them. 12 pairs of opposed buttresses along the two long walls of the tank support the 6m high walls as well as carrying the walkways around the perimeter of the tank. The eight buttresses in the south-western wall have recesses for the double slatted wooden beaches* to minimise the reflection of waves generated during experiments. Towards the south-west end of the tank there is a rotating arm* 29m in length, supported by a central post which descends below the water and stands on a concrete base 6m in diameter constructed on 15m reinforced concrete piles. The arm itself is constructed from tubular steel. It is driven by an electric motor and can rotate through 360 degrees. It supports a model-testing carriage* which can move along the length of the arm to vary the radius of manoeuvring experiments between 7.5m and 27.5m. Two banks of five plunger-type wave generators, colloquially known as ‘nodding donkeys’, were originally positioned along the north-east end of the tank and along the eastern half of the north-west side. During upgrades in 2014 the redundant wave generators were all removed, but the supporting concrete pillars with cantilevers have been retained in situ across the north-east end and eastern half of the north-west side of the tank. The entire wave generating plant now operates from the north-east end of the tank, comprising a single bank of 122 electrically actuated flap-type wavemakers*. A dock area used for rigging model ships adjoins the south-western wall of the tank and is separated from the main body of water by a dock gate. Above the dock, raised on a steel frame, is a glass-fronted control room used for operating the rotating arm. A similar control room* used for operating the wave generators stands at the opposite end of the tank. A further control room* stands at floor level in the south corner of the space, and along part of the north-west side there are partitioned storerooms.

Above the tank the pitched roof is carried on exposed trusses of tubular steel that span the entire width of the building. Nine main trusses are carried on the buttresses that extend from the long walls of the tank, crossed above by tertiary Howe trusses parallel to the roof ridge. Suspended beneath the main trusses are four rows of corrugated aluminium sheets supported by steel frames that run the length of the tank and correspond with the four rows of skylights above to break the light entering from the roof.

The lower sections of the tank building walls beneath the aluminium panelling are of red brick cavity wall construction and form both the lower sections of the tank building and adjoining wall of the ancillary buildings which wrap around the tank on all four sides. These ancillary buildings contain offices, workshops and plant rooms, accessed by a corridor that runs around the outer wall of the tank. This corridor has doorways through hexagonal bulkheads at irregular intervals. The bulkheads correspond with the buttresses supporting the concrete tank. A large room at the south-west end of the building, accessed via the principal entrance to the south-west elevation, originally housed the preparation rooms for wax, thermoplastic and wood models. Some partitions* have since been added to the south corner of this space to subdivide it. Staircases leading up to the tank walkways are located at either end of this area. During the 2014 renovations additional partitions* were added to the south-east corridor to create enclosed offices where some of the rooms were originally open to the corridor. The corridor and adjoining rooms have suspended ceilings* and simple doorframes* and doors* of timber. There is an incomplete set of hydrometers attached to pillars around the ground floor of the tank, which were used to measure the extent to which the building settled and tilted when the tank was first filled with water.

EXCLUSIONS * Pursuant to s1 (5A) of the Planning (Listed Buildings and Conservation Areas) Act 1990 ('the Act') it is declared that these aforementioned structures and/or features are not of special architectural or historic interest. However, any works to these structures and/or features which have the potential to affect the character of the listed building as a building of special architectural or historic interest may still require Listed Building Consent (LBC) and this is a matter for the Local Planning Authority (LPA) to determine.

Sources

Books and journals

Brown, D, The Way of a Ship in the Midst of the Sea: The Life and Work of William Froude, (2005)

Other

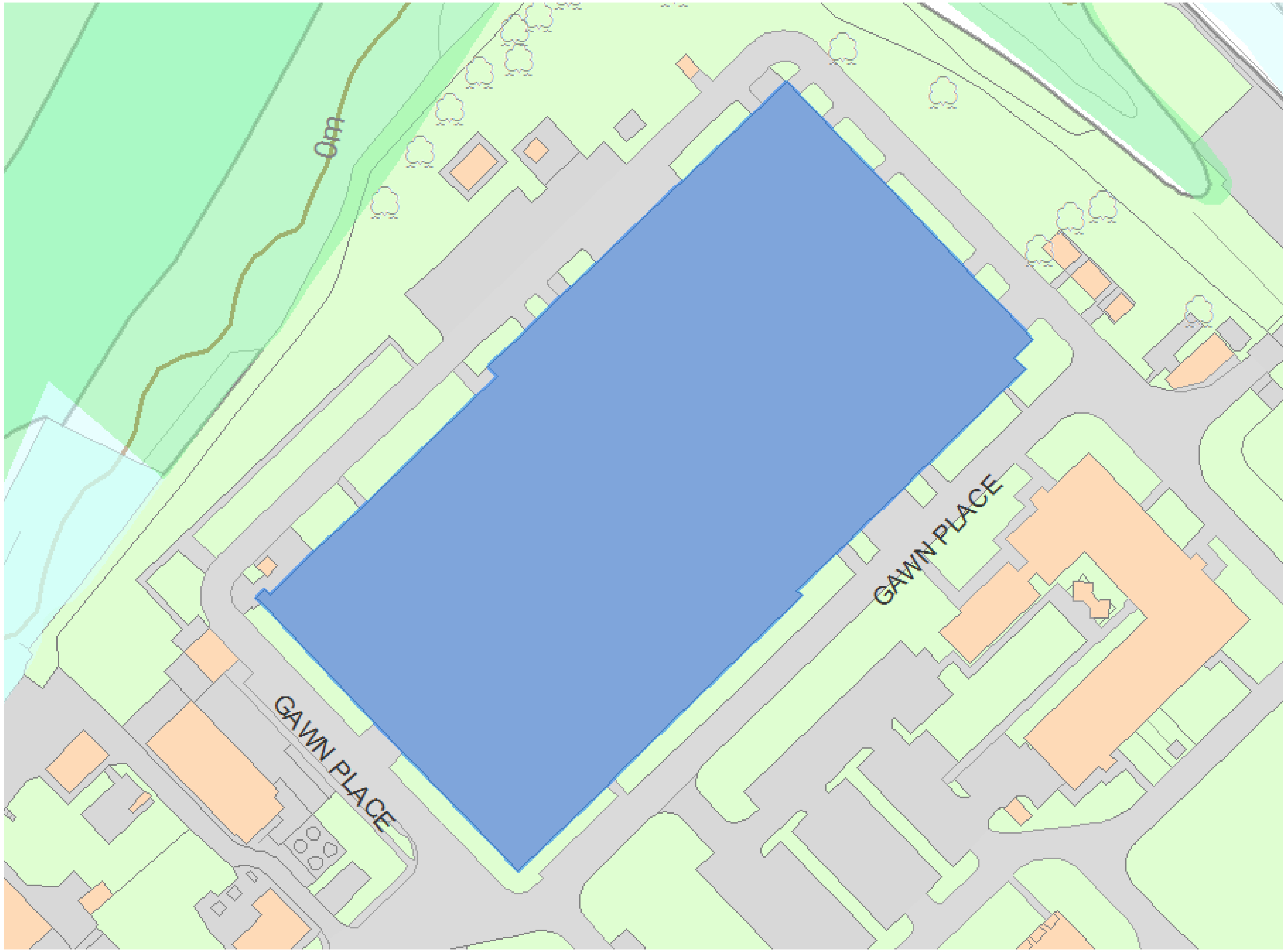
Bristow, M, The Admiralty Experiment Works, Haslar Road, Gosport, Historic England Research Report Series no. 11-2016 (2016)

[Unpublished report].
Historic England Archive, MD95/06480, 1917 plan of AEW Haslar

Legal

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

The listed building(s) is/are shown coloured blue on the attached map. Pursuant to s1 (5A) of the Planning (Listed Buildings and Conservation Areas) Act 1990 ('the Act') structures attached to or within the curtilage of the listed building but not coloured blue on the map, are not to be treated as part of the listed building for the purposes of the Act. However, any works to these structures which have the potential to affect the character of the listed building as a building of special architectural or historic interest may still require Listed Building Consent (LBC) and this is a matter for the Local Planning Authority (LPA) to determine.



Map

This map is for quick reference purposes only and may not be to scale. This copy shows the entry on 11-Nov-2022 at 15:19:07.

End of official list entry

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