

ROBERT WHITEHEAD – THE ENGLISH ENGINEER

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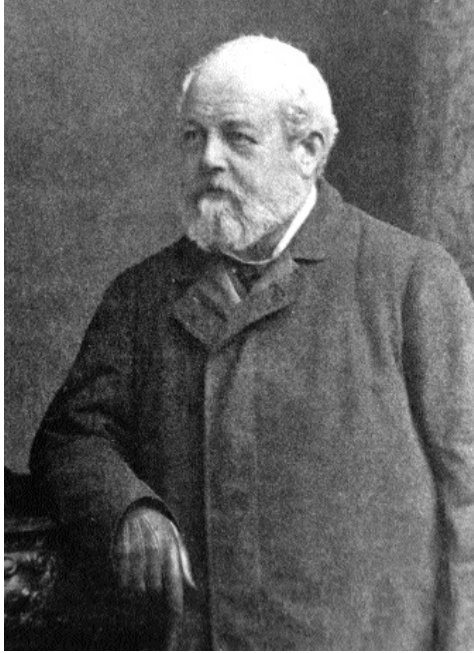
When Robert Whitehead died on November 14th 1905 the **Times** newspaper drew attention to his lack of official recognition in England and observed: ‘Quite unaccountably (his invention) has brought him no public recognition in the form of honours or distinctions he received (an) abundance, but he must have felt, as we believe he did, that the neglect of his own country was thereby rendered the more conspicuous’.⁽¹⁾

Despite the publication of Robert’s biography in 1975 followed by the enlarged edition issued by the Naval Institute Press in 1991, his engineering achievements and his influence on naval warfare remain largely unacknowledged and unremembered in Britain beyond the restricted circles of naval history enthusiasts. It is ironic, therefore, that it has fallen to Croatia, and in particular, Rijeka, to honour him in this conference. Family letters reveal that the ‘old gentleman’ relished the glittering foreign honours he received from all over the world during his lifetime and I am quite sure he would have been both astonished and pleased by this tribute to his work by the citizens of Rijeka whom he truly loved, respected, and admired.⁽²⁾

In a letter to her brother James, Whitehead’s daughter Alice revealed her father’s delighted reaction to various proposals by the local townspeople to honour him when he paid off the debts of the bankrupt **Stabilmento Tecnico Fiumano** on purchasing the factory in 1875 although he was under no legal obligation to do so. ‘Papa begged them not to tank him’, she wrote, ‘but it has been a great great pleasure to him. It is so nice to see how modestly and surprisedly he takes all the fuss they make of it. The whole town rings with it (and) they have all sorts of proposals to do him honour, the least startling of which (is) a monument; and to make him **Ehrenbürger** (an honorary citizen) of Fiume. I hope they will only do the latter (for) Papa would not like the former’.⁽³⁾

So how did this modest English engineer come to be in Fiume in the first place? And why was he held in such high esteem by its citizens?

Whitehead’s English roots can be traced back for many generations – his earliest recorded ancestor, born in November 1608, being David Whitehead who lived in the Lancashire village of Padiham just sixteen miles from Robert’s own birthplace in Bolton. The inventor’s great-grandfather, Thomas Whitehead, who died in



Robert Whitehead



Single propeller Whitehead torpedo - probably 16-inch model, 1875

1788, was an Anglican clergyman who served as a curate in two local parishes in the Bolton area. Religion, however, was to cause a rift in the family two generations later when Robert's father, James Whitehead, joined the congregation of the Swedenborgian chapel. His new allegiance led to a drastic change in the social and economic circumstances of the family. Robert's uncle John, although the younger brother, inherited his father's prosperous bleachworks at Elton and married into the wealthy and influential Oram family – his descendants achieving important positions in the British establishment – while the inventor's father took over the family's cloth-finishing business and lived next door to the factory in the industrial heart of Bolton surrounded by noisy mills and smokeenveloped foundries – a sharp contrast to the luxury of the family home at Haslem Hay which was now occupied by his uncle John.

James's marriage to Ellen Swift in 1814 undoubtedly contributed to Robert's aptitude for things mechanical for his mother, too, came from engineering stock – her father being a partner in Thompsom, Swift & Cole well-known for its steam engines and hydraulic presses as well as producing all the other types of machinery on which the factories of the Industrial Revolution depended.

Robert, the second child of the marriage, was born on January 3rd 1823 – from an historical perspective, during the reign of George IV and only eight years after the battle of Waterloo – and from his earliest years was surrounded by the bustle and excitement of the new industrial age. The mills and factories of Bolton were already employing 39 steam engines in 1823 – yet their combined output of 913 horsepower failed to equal many of the marine engines Whitehead was to build in later life. But the smell of steam and hot metal entered his blood at an early age and gave him a lifelong interest in mechanics. In one of her letters Alice noted that while cruising on Prince Liechtenstein's steam yacht **Hertha** 'Papa ...kept pottering about the engines... and falling asleep on every cosy corner in the most lazy and delightful manner' instead of engaging himself in the trivial social chatter of his host's other guests. This, of course, was after he had achieved fame and fortune.⁽⁴⁾

Whitehead was educated at Bolton Grammar School from 1829 to 1837 followed by a further two years of private tuition. During this period his father gave up his cloth finishing business and began trading as a wholesale brewer – the pumping machinery for the vast vats of beer being designed and built by the family firm of Thompson, Swift and Cole and the young teenager seemed unduly fascinated by the gleaming copper pipes of the brewer's complex pumping system.

In 1839 he joined the Manchester engineering company Richard Ormerod & Son managed, at the time, by his mother's brother William Swift. One early task found Robert perched high above the ground on the narrow girders of the city's Piccadilly railway station in London Road while he helped the fitters bolt together the vast iron roof sections. He then progressed to the workshops to gain practical experience in handling machinery before moving on to the drawing office where his exquisite skills as a draughtsman were quickly appreciated.

Working hard by day he also studied mechanical drawing and pattern designing for two hours every night at the Mechanics Institution half a mile away in Cooper Street. Some sources claim that his apprenticeship at Ormerods lasted for six years but it is unlikely that it extended beyond his 21st birthday at the beginning of 1844. His marriage to Frances Maria Johnson, however, can be precisely dated to March 30th 1846 by which time his occupation was proudly described in the parish register of All Saints Church, Old Byland, as ‘engineer’.

Robert’s uncle William Swift had meanwhile left Ormerods to join the La Seyne shipyard at Marseille – which had been purchased by the English entrepreneur Philip Taylor in 1845 – and within months of the wedding Whitehead and his bride crossed the Channel and made their way south to the French Mediterranean coast. He quickly settled happily into his new environment where he gained a valuable working knowledge of shipbuilding and marine engineering. He was also impressed by his new employer’s benevolent paternalism towards his workforce and it was Philip Taylor’s benign influence that led Robert to treat his Rijeka employees like members of his own family when he finally made his name and fortune from the torpedo.

Still young, and eager to carve his own way in life, Whitehead only remained at La Seyne for two years before he and his new wife set out in search of fresh horizons – this time making their way across the kingdom of Piedmont and northern Italy to Milan at that time part of the Austro-Hungarian empire, where he set up business as a consulting engineer. It was an appropriate choice for the city’s prosperity owed much to its age-old silk spinning mills which, as the industrial revolution swiftly engulfed Europe, enabled it to develop a dominant position in the expanding cotton and textile trades. Whitehead thus found himself in a familiar, if foreign, environment similar to that of his native Bolton – even to the extent of both towns sharing the same grey damp climate so necessary to the processing of cotton. He also welcomed the security offered by the politically stable Austrian empire. As events were to prove his optimistic confidence was sadly misplaced.

He was soon designing machinery for the manufacture of textiles and carefully protected his inventions with patents. The future beckoned brightly to the young expatriate engineer but the revolutions that swept Europe in 1848 brought him personal disaster. The people of Milan rose against their Austrian overlords and after five days of fierce street fighting the citizens routed General Radetsky’s 20.000-strong garrison. The newly formed provisional government issued an edict annulling all patents on the grounds that they were granted by a foreign power and, virtually overnight, Whitehead’s precious assets vanished. Milan’s independence, however, was short-lived. General Radetsky regrouped and, defeating the Piedmontese army at the battle of Custoza, reoccupied Milan and returned it once more to Austrian control.

Whitehead was shaken by the bloody events of 1848. His business had been ruined, his future was uncertain, and the fighting he had witnessed left him with such a

loathing of war and violence that he became a virtual vegetarian, eating meat only when social etiquette made it impossible to refuse. He developed a similar distaste for shooting and other blood sports and carefully avoided involvement in such pastimes throughout his life. Yet, paradoxically, he was to invent a weapon that was, in the course of two world wars, to kill tens of thousands of sailors. Robert, however, regarded the torpedo as a means of sinking ships rather than killing their unfortunate crews and considered the weapon to be a **deterrent** to war.⁽⁵⁾

Milan also held other personal unhappy memories for his wife, Frances, had lost their first child in infancy during this difficult period and, as she was now pregnant again, it was essential for the family to find a new and safer place in which to live and work. Before finally quitting northern Italy, however, Whitehead was engaged by the provincial Austrian administration to assist with an ambitious scheme to drain the Lombardy marshes. This mammoth task enabled Robert to demonstrate his skills as an engineer in the public arena and the publicity helped to boost his growing reputation. There is little doubt that his experience with the brewing machinery supplied to his father by Thompson Swift & Coles proved invaluable when he came to design the pumping engines which were employed to carry out this massive drainage project.

There is little doubt that his work in Lombardy led to an appointment with the Austria-Lloyd shipbuilding company as a constructor at their yards in Trieste. This steady yet unplanned progress eastwards across southern Europe almost suggests that destiny was leading him to Fiume although Whitehead was never aware of his guiding star.

Austria-Lloyd enabled him to develop the skills he had first acquired at La Seyne and Robert settled happily into the easy-going Italian way of life which, family letters show, he much preferred to the more rigid structure of Austro-Hungarian society. Indeed his grandchildren, in later years, always referred to him by the Italian diminutive 'nono' (grandfather) in conversation. To add to his joy Frances gave him a daughter in May 1849 and spurred by this new responsibility he began to seek fresh employment with better prospects. His search was soon over when he was offered an appointment as Technical Director of another Trieste shipyard, Strudthoffs – a rapidly growing company engaged in supplying marine engines to the Austrian navy.

Whitehead, although only 26 years old when he took up his appointment, designed a number of power units for Strudthoffs including the propulsion machinery for the paddle-wheel sloop **Taurus** in 1851 and two years later he produced his first screw propelled marine engine. The same year saw the birth of his son John and in 1856 he designed and built the first cylindrical boiler to be constructed in the Austrian empire.⁽⁶⁾ As a measure of his engineering skills it should be noted that **HMS Alexandra**, the first British capital ship to be fitted with cylindrical boilers was not laid down until March 1873. The technical and theoretical knowledge he displayed on this occasion were to prove an invaluable asset when he came to design the high-

pressure air reservoir for the torpedo some ten years later. But his burning desire for independence continued to unsettle him and, although relatively happy with the Strudthoff brothers, he felt he needed a greater challenge.

In 1853 a group of business men in Fiume – now better known as the Croatian city of Rijeka – built a new factory and metal foundry planned primarily for the repair of steamships. This was a completely new venture for the city and with a shortage of native-born engineers of the required calibre the owners of **Fonderie Metalli**, as the factory was originally named, began to head-hunt for new blood. Robert Whitehead's reputation was spreading rapidly down the Adriatic coast and they had no hesitation in offering him the opportunity to manage their new factory. It was a proposition the English engineer felt unable to refuse especially as he was promised complete technical independence.

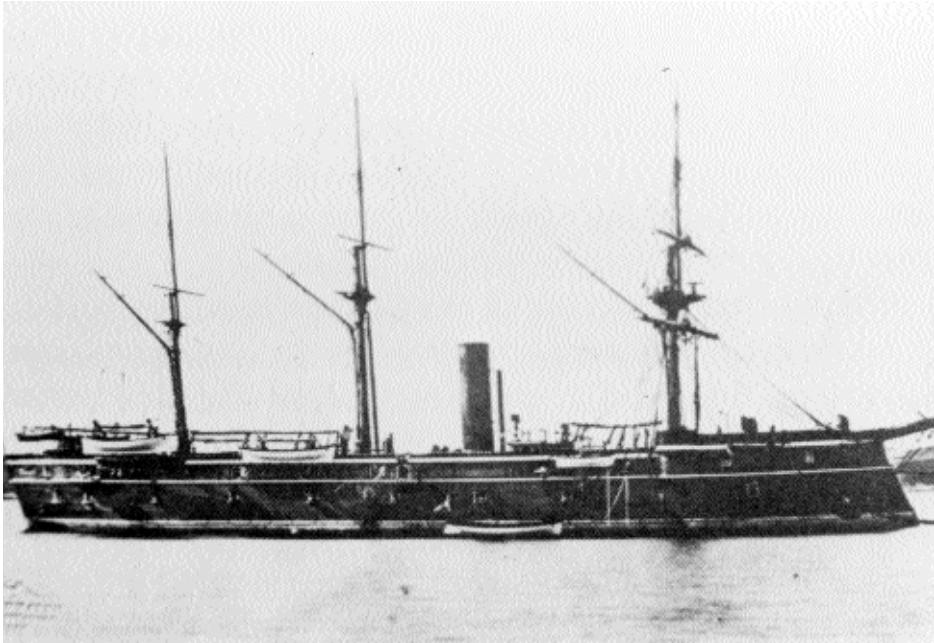
It meant commuting daily from Trieste to Rijeka to begin with but after a short period he and his young family were able to take up residence in a small red-brick house, the **Cassa Rossa**, situated on the factory site and overlooking the main gates leading onto the main highway from Rijeka to Abbazia. His star of destiny had finally come to rest.

Whitehead quickly changed the name of the company to **Stabilimento Tecnico di Fiume** and concentrated the factory's originally limited resources on the construction of steam-powered units moving within a few years from donkey engines and steam winches to the production of full-sized marine power plants – many of which were supplied to the growing Austrian navy. Like Henry Royce a generation later, Whitehead was a disciple of good solid workmanship and could frequently be seen on the floor of the factory with his coat off and his sleeves rolled up showing a machinist or fitter how a job **should** be done.

The English engineer was at last in his element, enjoying complete autonomy over the technical side of the business while his colleagues concentrated on financial matters and sales. With the birth of a second son, James Beethom, in July 1858 and by then also the father of two fine daughters, Frances Eleanor and Alice, Whitehead was very much a family man. And living inside the factory gates his work and his children intermingled freely and happily.⁽⁷⁾

The gathering storm clouds of German and Italian unification led the Austrian government to expand its military forces and the rapidly growing STF factory was given a contract to build the engines for an armour-plated screw frigate, **Archduke Ferdinand Maximilian** – more usually known as the **Ferdinand Max** – which had been designated as the flagship of the new fleet. Unbeknown to Whitehead this apparently routine order was to reap unexpected rewards when hostilities finally erupted in 1866.

The genesis of the modern self-propelled torpedo also made its appearance during this restless and uncertain period. Somewhere around 1860 an unidentified officer of the Austrian Marine Artillery devised plans for a small surface craft, just



Ferdinand Max

a few feet in length which, when packed with explosives, could be used to attack warships blockading close inshore. On his death the papers came into the hands of another retired officer, Fregattenkapitan Giovanni Luppis, who by a bizarre coincidence was a resident of Rijeka. Although it bore no resemblance to Whitehead's subsequent submerged weapon, the craft, known as **Der Küstenbrander** or coastal fireship, deserves a brief description because of its importance in the torpedo story.

Constructed of timber, it was propelled by a clockwork motor which turned a stern-mounted screw. Behind this propeller was a large rudder which was controlled by an operator ashore using rope tiller lines. A gunpowder charge carried inside the hull was detonated by a percussion impact device set into the bows – this latter being virtually the only feature it was to share with Whitehead's fish torpedo. More importantly, and in contrast to the latter, it ran on the surface. Satisfied that he had produced a war-winning weapon Luppis took a scale model of the device to the naval authorities in Vienna who, for obvious reasons, were less than impressed by the Fregattenkapitän's rather crude toy. The admirals, however, sensed the weapon's potential and advised Luppis to seek the assistance of a professional engineer.

Returning to Fiume he was introduced to Whitehead by local business man Giovanni de Ciotta. And although the Englishman quickly discounted the viability

of the primitive contrivance which Luppis had brought to him, Robert, like the Vienna admirals, instinctively sensed that the coastal fireship contained the germ of a workable idea. But when, after months of hard work modifying the prototype failed to yield results, he realised that it was so flawed in concept that it was virtually useless.

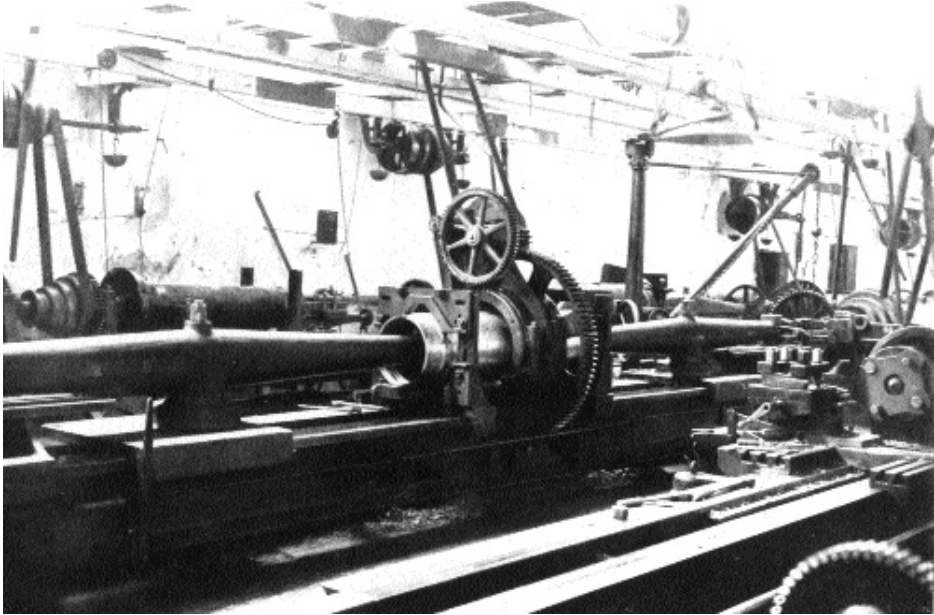
Whitehead, however, found that he had been bitten by the torpedo bug as well and, locking himself away in a small workshop in the STF's factory yard and helped only by a trusted mechanic, Annibale Ploech, and his eldest son John – the latter not yet even a teenager – Robert spent the next two years designing and building a revolutionary weapon that not only ran submerged to its target but was also powered by a pneumatic oscillating engine of his own creation which was fuelled by compressed air contained within a pressurised reservoir, independent of the external atmosphere, inside the 14-inch diameter body – itself constructed from wrought iron boiler plates. Built from scratch with virtually every single mechanism originating in Whitehead's agile brain it was, despite its initial shortcomings, a technical miracle the like of which had never been seen before.

Although it was as unlike the Luppis explosive boat as a Bleriot monoplane is to a Boeing 707 – although even these rely on similar aerodynamic principles to fly – Whitehead generously entered into a partnership with the retired officer and described his invention as the Luppis-Whitehead torpedo. In truth, however, the English engineer had been responsible for virtually 100% of the creative technology involved in producing it.

Despite his optimism the prototype was bedevilled with faults – not least its inability to maintain a steady depth. Its maximum speed of 6 knots was unacceptably slow for combat use while its range of 330 yards was woefully inadequate although it was clear that these latter disadvantages could be overcome with further development work.

But circumstances mean that Whitehead had to strike while the iron was hot. He had just achieved international fame for designing the engines that had powered von Tegethoff's flagship, **Ferdinand Max**, to victory over the Italian fleet at the battle of Lissa fought on 20 July 1866 and, exploiting his new-found celebrity, he pulled a few influential strings and persuaded the Austrian navy to test his new weapon.

The first hurried trials staged in December of that year were disappointing and the torpedo's erratic depthkeeping failed to impress the assembled admirals although they shrewdly recognised the weapon's potential and Whitehead despondently packed his bags and returned to Fiume to carry out further development work on the project. The depthkeeping problem was solved with a sudden flash of inspiration which came to Robert some months later while he was in bed and asleep. The relatively simple pendulum and hydrostatic valve mechanism which he hastily scribbled on a piece of paper was to form the key to the torpedo's success and his own personal fortune.



Air-vessel boring machine



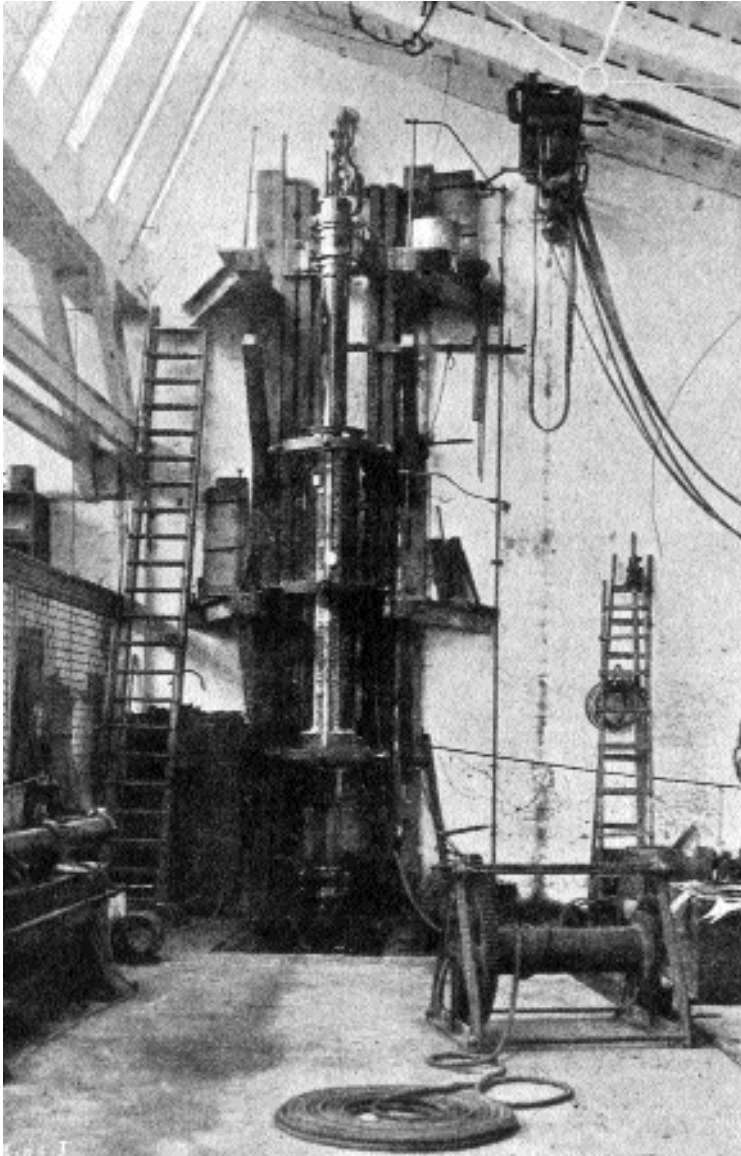
End view of No. 2 bay, looking east



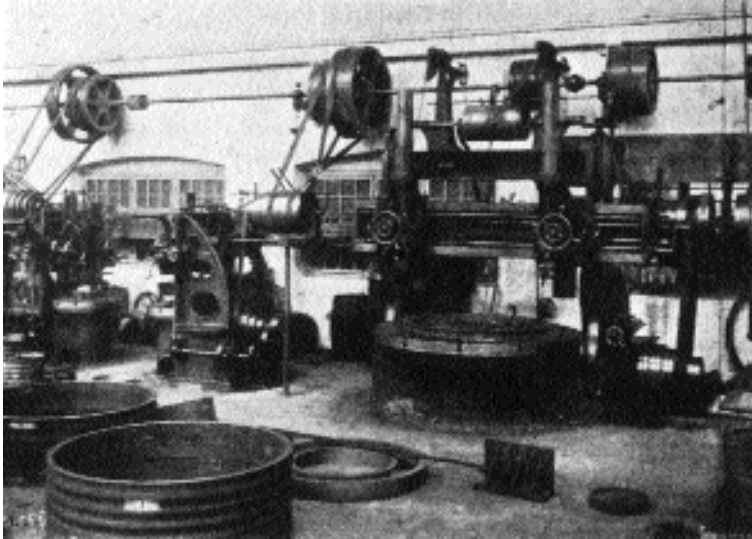
Group of finished torpedo-impulse tubes



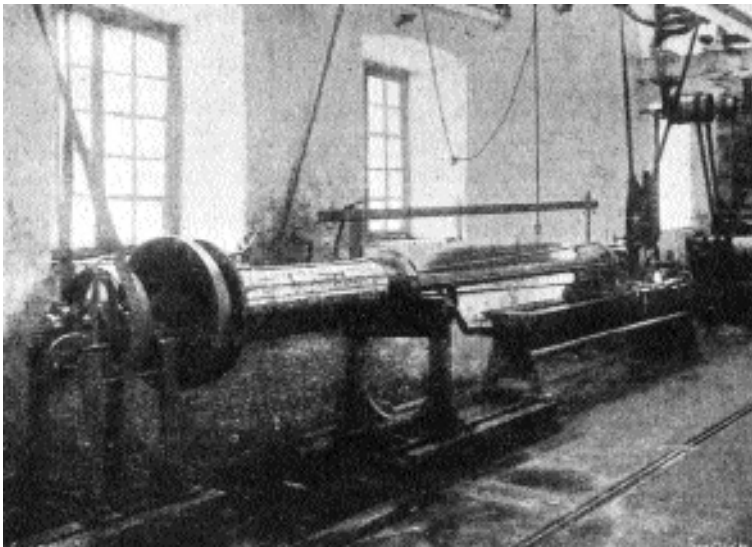
View of No. 3 bay, looking east



Vertical boring mill for torpedo tubes



Group of horizontal lathes



Grinding out an impulse tube

Following further trials in 1868 the Austrian navy agreed to purchase the non-exclusive rights to the weapon and he received further recognition when he was raised to the rank of baron for his engineering contribution to the victory at Lissa. His prize-winning entry at the Paris Exhibition the previous year had already been rewarded by a personal gift from the Emperor. The world truly became his oyster, however, when the British government agreed to buy the torpedo in the wake of the extensive Sheerness trials in 1870 at which both the 14-inch and 16-inch versions of the weapon passed the rigorous tests laid down by a committee of Royal Navy experts.

Britain sought and obtained a licence to build the Luppis-Whitehead torpedo at the Royal Laboratory inside Woolwich arsenal although, such was the demand for the revolutionary new weapon, substantial orders were still placed with the Fiume factory. In fact by the end of 1879 Whitehead had already sold 1,803 torpedoes to nine of the world's navies. This figure, moreover, only includes the new and improved 14-inch and 15-inch Whitehead weapons which began rolling off the Fiume production line in 1875 – the consignment of torpedo serial number 1 to Germany being shown in the factory's ledger as 26 January 1875. By August 1914 the cumulative serial number had reached 13168.⁽⁸⁾ No records have been traced of the pre-1875 14-inch and 16-inch 'standard' Luppis-Whitehead torpedoes.

Quickly realising that his underwater goose was about to lay a clutch of golden eggs, Whitehead astutely took the precaution of varying his partnership agreement with Giovanni Luppis. This resulted in the Austrian officer continuing to receive his share of the income from the prototype 14-inch and 16-inch weapons – which were out of production by 1875 – while leaving the English engineer free to develop the weapon independently and to retain all the ensuing profits. It is said that Luppis died a disappointed man some while later.⁽⁹⁾ Although his treatment may seem to be harsh it must be accepted that the concept of the self-propelled submerged torpedo sprang entirely from Robert Whitehead's fertile brain and owed nothing whatsoever to the anachronistic **Küstenbrander**.

Control of the factory also changed in 1875 when the old **Stabilimento Tecnico Fiumano** was declared bankrupt and, seizing the opportunity, Whitehead purchased the premises and equipment which he later reorganised on modern flow-production principles. The new business became **Torpedo-Fabrik von Robert Whitehead** although it was better known throughout the world under its Italian name of **Silurficio Whitehead**.

Exhaustive research during the preparation of my latest book **Nineteenth Torpedoes and Their Inventors** has confirmed that no one else had produced a practical underwater weapon capable of competing with the Whitehead torpedo before the first Austrian trials in 1866 – although several had tried. Robert Fulton had built and publicly demonstrated a towed torpedo in 1801 and produced drawings of a spar weapon but had, typically, failed to develop either weapon. No

evidence has been found to support the claim that, in partnership with Joel Barlow, he had built a self-propelled torpedo as early as 1797 and modern historians doubt the veracity of the story. In any event, as it allegedly exploded and the two men barely escaped with their lives, it was clearly unsuccessful.

Two English engineers, George Warsop and his colleague Brentall, constructed a form of submerged torpedo in 1862 – some four years ahead of Whitehead – but it had no depth-control mechanism and ran supported by floats on the surface. Its power unit was fuelled by compressed air and, like **Der Küstenbrander**, it was steered by means of tiller lines from the shore. Its speed and range are unknown although a scale model was tested by the Royal Navy at Portsmouth in June of that year. The Admiralty's Torpedo Committee report published in July 1876 dismissed it as failing 'to achieve its purpose... and considered it so defective in principle... as not to merit further trial'. Or, to put it more simply, it didn't work!⁽¹⁰⁾

Another torpedo dating back to 1868 – two years after the initial Austrian trials of the Luppis-Whitehead – was invented by Philip Braham. It was, however, no more than an explosive air and propelled through the water by the impetus of the original discharge. It was probably useless beyond a range of twenty yards or so. John Ericsson produced a similarly inadequate projectile torpedo several years later but neither weapon was comparable with the relatively efficient Fiume torpedo.

Andrew Alexander had patented an 'exploding submarine missile' on July 27th 1864 which, well ahead of its time, relied on rocket propulsion. Unfortunately the device was never built and was little more than a theoretical exercise although, admittedly, of some considerable technical ingenuity.

John Ericsson's pneumatic torpedo is usually dated to 1873 but may have been designed some time earlier for the Scandinavian inventor claimed to have provided details of the weapon to the King of Sweden and Norway in November 1866 – although it does not follow that it had actually been built by that date. Once again the Swedish engineer's weapon, in practical terms, cannot be placed in the same league as the Whitehead. Although powered by compressed air this was supplied to coffin-shaped weapon unmanageable in the water. Details of its depth-control gear – if it ever had any – have never been traced and the weapon, in general terms, was a total failure.

It was, however, of historical significance as being the first torpedo to be driven by twin contra-rotating propellers – a concept patented by Ericsson in 1836.⁽¹¹⁾ Unfortunately his employment of straight cogs made the mechanism so unwieldy that it could never have been fitted into the narrow confines of a 16-inch diameter fish torpedo. The system introduced into the Woolwich-built version of the Whitehead weapon in November 1874⁽¹²⁾ made use of bevel gearing developed by a prominent Scottish engineer and was adopted by Robert Whitehead for his new Fiume 14-inch Model A in 1878 and retro-fitted into the earlier 15-inch torpedo before it became standard equipment for the 15-inch Model B although he had to obtain permission from the British government before he could do so. It was one

of the few major improvements in torpedo technology that did not spring from Robert's agile brain.

Another development which Whitehead inexplicably failed to notice or exploit was that of the heater principle in which the warming effect of seawater, or the use of a naked flame, is employed to heat the compressed air that powered the engine to produce increased speed. In fact thirty years were to pass before the Fiume factory began to produce heater units for their torpedo engines – to be precise, 1906!

The effect of heating compressed air or liquid gas was first observed by the now virtually unknown Colonel Victor von Scheliha and was described in his provisional patent taken out in 1872.⁽¹³⁾ This retired German army railway engineer could have been a serious rival to the Whitehead factory in its early days had the Colonel not developed his initially promising idea into a massive and impractical wapon consisting of a tractor unit towing one or more torpedoes each of which carried explosive charges that could be launched remotely by electricity or, more simply, by a time delay mechanism. The Duke of Wellington's nephew who at the time was serving as the British military attache in St Petersburg, confirmed in his memoirs that he had watched a successful demonstration of the torpedo on the Neva river in 1872, so it must be accepted that von Scheliha's weapon worked in its original development stage.⁽¹⁴⁾

The German colonel was by no means the only inventor to head compressed air although he appears to have been the first. Many others were to follow including John Lay, Henry Julius Smith and Hudson Maxim.

It is difficult to understand how Whitehead failed notice these developments which were widely reported in the technical press as well as being the subject of numerous patents both in England and the United States. He was not alone, however, for the scientists at the Royal Laboratory did not observe the phenomena until 1901 when it was greeted with a considerable fanfare of publicity. It can only be concluded that both the Woolwich technocrats and Whitehead had an arrogant disdain for the work and patents of other torpedo inventors and did not bother to keep abreast of what was happening in the wider world beyond Fiume and the Royal Laboratory.⁽¹⁵⁾

Whitehead was, however, inventively active in other fields of torpedo development. He investigated the properties of the gyroscope in the early 1890 when it was little more than a children's drawing-room toy and by 1895 he was fitting it into all of his torpedoes to improve its directional stability. In fact Robert found a practical use for the gyroscope a full year before Elmer Sperry entered the arena. He also experimented with turbine propulsion for the torpedo long before other engineers became involved. A family letter from Robert to his eldest brother William revealed that development work was taking place as early as 1891.⁽¹⁶⁾ However difficulties in gearing down the rotational speed of the turbine sufficiently for it to transmit power to the propellers led him to abandon his experiments. As he was by then 70 years old his waning enthusiasm can be

forgiven. Possibly for the same reason he evinced no interest in the potential advantages of replacing his compressed air power units with electric motors.

Although he continued to produce engineering drawings into his old age and kept a close eye on events at the Fiume factory, Robert finally retired to his native England shortly before his wife died in 1883. Abandoning the Villa Whitehead which he had built behind the torpedo factory in the 1870s alongside the residence of his son-in-law and business partner, Count Georg Hoyos – the latter now taking over the day-to-day management of the torpedo works – Robert began to indulge in a mania of buying, selling and leasing real estate, losing heavily on his investment in Paddockhurst when unreliable acquaintances exploited his financial naivety and brought him close to ruin. In his hey-day, when he was feted by governments, kings and emperors, Whitehead had his own private Pullman railway coach in which he travelled all over Europe in opulent style.

Perhaps the zenith of his position in European society was achieved in 1892 when his grand-daughter Marguerite Hoyos married Count Herbert von Bismarck-Schönhausen, the son of Prussia's iron chancellor in Europe's wedding of the year. Whitehead's own second son, James, a career diplomat, received a knighthood for his services to the British crown and one of his sons, Edgar, rose to become Prime Minister of Southern Rhodesia (Zimbabwe) after the Second World War.

Despite his riches Robert remained a simple man at heart. And although pleased by the honours showered upon him, he remained modest and self-effacing. In an undated letter Maud Scott, one of his house guests at Paddockhurst, has left this endearing thumbnail sketch of the inventor in his later years: 'The old gentleman, who by this time was stone deaf, sat in his chair smilingly watching all of us – happy to see us happy. He was of stout build and not very tall, with a most lovely crop of silver-white hair and such a kind face.'⁽¹⁷⁾

Whitehead died on Tuesday November 14th 1905 having lived just long enough to see his fearsome weapon's influence on the outcome of the war between Russia and Japan. His thoughts on the cost in human lives resulting from the torpedo's use during the assault on Port Arthur remain unknown, but must have caused him genuine pain.

He was buried in England in the Sussex village of Worth – a torpedo lovingly constructed from white flowers surmounting the coffin as it rested before the altar in the old Saxon parish church. A simple tombstone marks his grave in the tranquil churchyard and bears the inscription: **His fame was in all nations round about.**

This conference, being held nearly one hundred years after his death, is proof indeed that Robert Whitehead's fame remains undiminished by the passage of time. May I, on behalf of the family, thank the people of Rijeka for keeping his memory alive.

NOTES & SOURCES

1. **The Times** 15 November 1905
2. The personal details of Whitehead's life are based on conversations by the author with his grand-daughter Frances (Lady John Bowman) over a long period and his grandson Thomas Whitehead. His daughter's son Count Balthazar Hoyos also provided anecdotal recollections. Sadly, all three are now deceased.
3. Letter to James Whitehead by his sister Alice Hoyos (Robert's daughter) dated 27 January 1877
4. *Ibid*, 26 April 1878
5. **The Times** 15 November 1905
6. **Centenary Book of the Cantiere Riuniti Dell Adriatico**. Page 16. Trieste, 1957 Author and publisher not known
7. A detailed account of Whitehead's career and private life will be found in **The Devil's Device**. Gray. Naval Institute Press, Annapolis, 1991
8. Extracted from the factory's consignment ledger a copy of which is held by the author by courtesy of Denis Cahill.
9. Caseli & Cattaruzza. **Sotto i mari del mondo – La Whitehead 1875–1990** Italy. Editori Laterza
10. Public Records Office. London. ADM 116/163. p xi of the report
11. British patent No 7149. 13 July 1836
12. Letter from Colonel G. Frazer of the Royal Laboratory, Woolwich. 23 June 1877. The full story of the contra-rotating propeller saga will be found in **Nineteenth Century Torpedoes and their Inventors** by Edwyn Gray which is due for publication in December 2003 by the Naval Institute Press, Annapolis. ISBN: 1591143411
13. British Provisional patent No 3536. 25 November 1872
14. **Recollections of a soldier-diplomat**. Honorable Frederick Arthur Wellesley. Ed. Sir Victor Wellesley. p 122 Ca 1931. London. Hutchinson & Co
15. Letter to Vivienne Hancock quoted in **The Devil's Device** p 125

Sažetak

ROBERT WHITEHEAD – ENGESKI INŽENJER

Edwyn Gray

Whitehead nikada nije doživio počast u Engleskoj. Jednostavno i skromno radovao se počastima koje je primao u inozemstvu. Bio bi oduševljen ovim današnjim priznanjem građana Rijeke koju je volio i uvažavao.

Najstariji predak rođen 1608. godine. Kratka povijest obitelji i njegov profesionalni okvir. Obrazovanje. Naukovanje u Engleskoj. Ženidba. Odselio u Francusku i radi u brodogradilištu La Seyne – tu je dobio uvod u brodstrojarstvo. Seli se u Italiju, Milano, gdje radi kao inženjer-konzultant, ali gubi svoje patente tijekom revolucije 1848. Preuzima zaduženje u Austrijskom Lloydu prije ponovnog preseljenja u Strudtoffs u Trstu. Težeći k tehničkoj neovisnosti, prihvaća ponudu STF-a u Rijeci gdje je projektirao brodske pogonske strojeve, uključivo i stroj za admiralski brod Ferdinand Max. Njegov radni model broda dobiva nagradu na pariškoj izložbi – postaje svjetski poznat radi ključne uloge u pobjedi u bitci kod Visa (Lissa).

Upoznavši se s Giovannijem Luppisom pokušava razviti obalni vatrogasni brod, no koncept je bio previše loš da bi se s njim nastavilo. Međutim, taj je koncept potaknuo Whiteheada da konstruira vlastiti samopogonjeni uronjivi torpedo – zadatak koji mu je uzeo dvije godine, uz asistenciju njegova najstarijeg sina i povjerljivog mehaničara iz STF-a. Budući da je stekao ugled kod austrijskog cara radi uspjeha s admiralskim brodom, želio je iskoristiti priliku i organizirati pokus svojega oružja uz pomoć austrijske mornarice krajem 1866., no prijedlog je odbijen zbog nepreciznosti u održavanju dubine. U trenutku inspiracije, da bi riješio problem, smislio je njihalo i hidrostatički mehanizam pa su nakon pokusa koji su uslijedili Austrijanci kupili torpedo 1868., a dvije godine poslije to je učinila i britanska Kraljevska mornarica.

Whitehead je prvi čovjek koji je pronašao praktičnu primjenu žiroskopa – nekoliko godina prije Sperryja, a bio je i rani pionir u korištenju turbina, iako nije dugo išao tim putem.

Kratka usporedba s ostalim suvremenim izumiteljima torpeda, posebice s Johnom Ericssonom i Victorom von Schelihaom. Whiteheadova greška što nije prihvaćao ideje drugih ljudi. Nije pokazivao zanimanje za Ericssonove dvostruke kontrarotirajuće propelere dok Engleska nije prihvatila sustav sa stožnikom koji je izumio Robert Wilson, a ako pretpostavimo da je znao za patent, nije čak ni eksperimentirao s konceptom zagrijavanja komprimiranog zraka koji je prvi otkrio von Scheliha, a razvijali su ga brojni inženjeri radeći na torpedu u 19. stoljeću.

Njegov životni stil i položaj u austrijskom društvu – udaja njegove unuke u dinastiju von Bismarck. Uživao je u zadovoljstvu drugih ljudi. Njegova smrt i pokop. Veza između njegova epitafa i današnjeg priznanja koje mu odaje grad Rijeka. Njegova je slava kod svih naroda bila nestalna.

*Abstract***ROBERT WHITEHEAD – THE ENGLISH ENGINEER***Edwyn Gray*

Whitehead never honoured in England. His simple modest pleasure on receiving foreign honours. Would have been delighted by this recognition by the people of Rijeka whom he loved and respected.

Earliest known ancestor born in 1608. Brief family history and his engineering background. Education. Apprenticeship in England. Marriage. Emigrates to France to work at La Seyne shipyard – his first introduction to marine engineering. Moves on to Italy as a consulting engineer in Milan but loses his patents in the 1848 revolution. Takes up appointment at Austria Lloyd before moving on again to Strudhoffs at Trieste. Seeking technical independence he accepts an offer from STF in Fiume where he designs marine engines including that of the flagship Ferdinand Max. His working model of the ship wins prize at the Paris Exhibition – world famous for its leading role in the victory at the battle of Lissa.

Introduced to Giovanni Luppis he tries to develop the latter's coastal fireship but the concept was too flawed to pursue. However it provided the trigger for Whitehead to construct his own self-propelled submerged torpedo – a task that took him two years assisted only by his eldest son and a trusted mechanic from STF. Created a baron by the Austrian emperor for his success with the flagship he seized the opportunity to arrange a trial of his weapon by the Austrian Navy at the end of 1866 but, due to its erratic depth keeping, it was turned down. In a moment of inspiration he devises a pendulum and hydrostatic mechanism to solve the problem and following further trials the torpedo was purchased by the Austrians in 1868 and, two years later, by Britain's Royal Navy.

Whitehead first man to find a practical use for the gyroscope – a several years ahead of Sperry and he was an early pioneer in the employment of turbines although he did not pursue this path for very long.

Brief comparison with other contemporary torpedo inventors, in particular with John Ericsson and Victor von Scheliha. Whitehead's failure to assimilate other people's ideas. He showed no interest in Ericsson's twin contra-rotating propellers until England adopted the bevel-gear system invented by Robert Wilson and, assuming he was aware of the patent, he did not even experiment with the concept of heating compressed air first discovered by von Scheliha and developed by many other 19th century torpedo engineers.

His life style and position in Austrian society – the marriage of his grand-daughter into von Bismarck dynasty. His simple delight in other people's pleasures. His death and funeral. The link between his epitaph and today's recognition by the city of Rijeka. His fame was in all nations round about.