

Subject review / Pregledni rad

PATRICK CUNNINGHAM AND HIS “ROCKET TORPEDO”

Patrick Cunningham i njegov „raketni torpedo”

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SUMMARY

Key words: Robert Whitehead, Whitehead Torpedo, Patrick Cunningham, Rocket Torpedo, United States Bureau of Ordnance

Robert Whitehead's success story has been well documented by Edwyn Gray (1990), Antonio Casali and Marina Cattaruzza (1990) and more recently by Benito Petrucci in his monumental history of Whitehead Alenia Sistemi Subacquei (2008). However, Edwyn Gray in his Nineteenth Century Torpedoes and their Inventors (2004) provided us with an insight into the weird and wonderful of nineteenth century torpedo warfare. This paper focuses on the nineteenth century American inventor Patrick Cunningham and his Rocket Torpedo and the United States Bureau of Ordnance's search for a simpler and cheaper 'home grown' alternative for the Whitehead Torpedo.

Torpedoes and torpedo warfare. For some, these words conjure up images from Wolfgang Petersen's film *Das Boot*, or Tom Clancy's novel *The Hunt for Red October*. For others, it is the expatriate English engineer and inventor of the Whitehead torpedo, Robert Whitehead, who lived and worked in Fiume (Rijeka) in the later part of the nineteenth century. However, for every success story, such as Robert Whitehead's, there were tens, if not hundreds of 'failures' that have largely been forgotten, or only merit a sentence or two in specialist publications on torpedoes and torpedo warfare. Patrick Cunningham and his 'Rocket Torpedo' are no exception.¹

Patrick Cunningham was born in Dundalk, County Louth, Ireland, on May 4, 1844 and at the age of nine migrated to America with his parents. As a twenty

¹ Gray, Edwyn. *Nineteenth-Century Torpedoes and Their Inventors*. Annapolis: Naval Institute Press, 2004, pp. 199-200.

year old he enlisted in the Navy and served for a short time aboard the light-draft monitor USS *Tunxis* before being transferred to the gunboat USS *Huron* where he took part in the bombardment of Fort Fisher in December 1864 and the combined operation that culminated in its capture in January 1865. At the end of the Civil War he was transferred to the receiving ship USS *North Carolina* where on June 19, 1865, he jumped ship and was subsequently listed as a deserter.²

Like many young ex-servicemen, he found it difficult to adjust to civilian life after the Civil War. Eventually, in 1877, he settled in New Bedford, Massachusetts, where he found a ready market for his skills as a machinist and inventor.

Cunningham had developed an interest in explosives and projectiles while serving in the US *Huron* in 1864 and 1865 and had taken out patents for a 'Rocket' in 1882, a 'Line-Carrying Rocket' in 1889 and a 'Dynamite Rocket' in 1892.³ The committee appointed by the United States Life-Saving Service in 1887 to examine Cunningham's 'Line-Carrying Rocket' had some reservations regarding it and aerial rockets in general, these included: their erratic flight paths and the possibilities of explosions occurring before launching and during flight.⁴ They could have just as easily been writing about his 'Rocket Torpedo'. The problems were the same!

Cunningham's 'Rocket Torpedo' was a cigar shaped solid fuel rocket made in four sections each approximately four feet in length and having a total length of 17 feet and diameter of 15 inches with eight equally spaced fins forming a multi-start helix that extended from the base of its warhead to its tail. These were designed to impart 'spin' to the torpedo, stabilizing it in much the same way as the rifling of a gun improves the stability and accuracy of a projectile. The use of spin-stabilization to improve the stability and accuracy of rocket-propelled projectiles was not a new idea. William Hale the inventor of the Hale 'stickless' war rocket had taken out his first patent for spin-stabilized rockets in 1844.⁵ Furthermore, both Andrew Alexander (1864) and William Murphy and John Foster (1884) had advocated fitting spiral vanes to impart 'spin' to under water projectiles.⁶

² The charge of desertion was removed from Patrick Cunningham's service records in September 1892. Letter from Captain Samuel Conrad Lemly, Judge Advocate General of the Navy to Benjamin F. Tracy, Secretary of the Navy, 1892, US National Archives and Records Administration, Washington, Record Group 24, Record of the Bureau of Naval Personnel (Records Related to Enlisted Men Who Served in the Navy).

³ Cunningham, P., 1882, Rocket, US Patent 266, 437, filed Feb. 6, 1882, and issued Oct. 24, 1882. Cunningham, P., 1887, Line-Carrying Rocket, US Patent 395, 881, filed Nov. 30, 1887, and issued Jan. 8, 1889. Cunningham, P., 1891, Dynamite Rocket, US Patent 479, 738, filed June 24, 1891, and issued July 26, 1892.

⁴ Merryman, J. H., Lyle, D. A., Ross, W. G., Sparrow, R. C., Waters, J., 1888, 'Report of Committee on the Cunningham Line-Carrying Rocket.' *Annual Report of the Operations of the United States Life-Saving Service*, US Government Printers Office, pp. 502-507.

⁵ Hale, W., 1858, Rockets, UK Patent 2, 497, sealed May 6 1859, and dated November 8, 1858.

⁶ Alexander, A., 1864, Constructing and Exploding Submarine Missiles, UK Patent 1,869, dated July 27, 1864 (*This invention only received provisional protection.*). Murphy, W. J. and Foster, J. R., 1884, A Rifled Torpedo, UK Patent 9, 121, dated June 18, 1884 (*This invention only received provisional protection.*).



■ **Figure 1** Patrick Cunningham and his Rocket Torpedo, Beetles Boat Yard, New Bedford, Mass, USA, July 1893. Photograph by courtesy of US Naval War College Museum, Newport, RI, USA.

Three four-foot lengths, of eight-inch diameter iron pipe joined end to end by screw rings to form a 12-foot long solid fuel rocket filled with a slow-burning black powder based propellant compressed into a solid, hard mass that would burn at a predictable rate were housed within the body of the torpedo. Compressed black powder based propellants form brittle masses that fracture if handled roughly. The increased surface area at the fracture sites, or in voids formed in the propellant during manufacture produces a corresponding increase in exhaust gases and pressure that can cause a catastrophic explosion. Dividing the rocket into three four-foot long sections added a further complication in the form of two extra joints that required sealing.

Depth control was a major problem. William Hale had noted that rockets and rocket-propelled devices were difficult if not impossible to control underwater because they lost weight as the propellant was consumed.⁷ Cunningham attempted to solve the problem by 'burning the candle at both ends.' He hoped that by igniting the forward and aft charges in his rocket torpedo simultaneously and directing the exhaust gases from the forward charge into a steel combustion chamber behind the warhead and allowing them to escape via vents in the outer

⁷ Winter, Frank H. *The First Golden Age of Rocketry*. Washington: Smithsonian Institution Press, 1990, p. 245.

rim of the combustion chamber he could 'balance' the torpedo so that it ran at a constant depth.

He made no mention of these problems to Congressman Charles Sturtevant Randal, when he asked him to bring his 'Rocket Torpedo' to the attention of the US Bureau of Ordnance. Instead, Patrick Cunningham, the businessman and entrepreneur, chose to emphasise the extent of his financial commitment to the project and his reluctance to get others involved in it unless there was some prospect of them recovering their investment.⁸

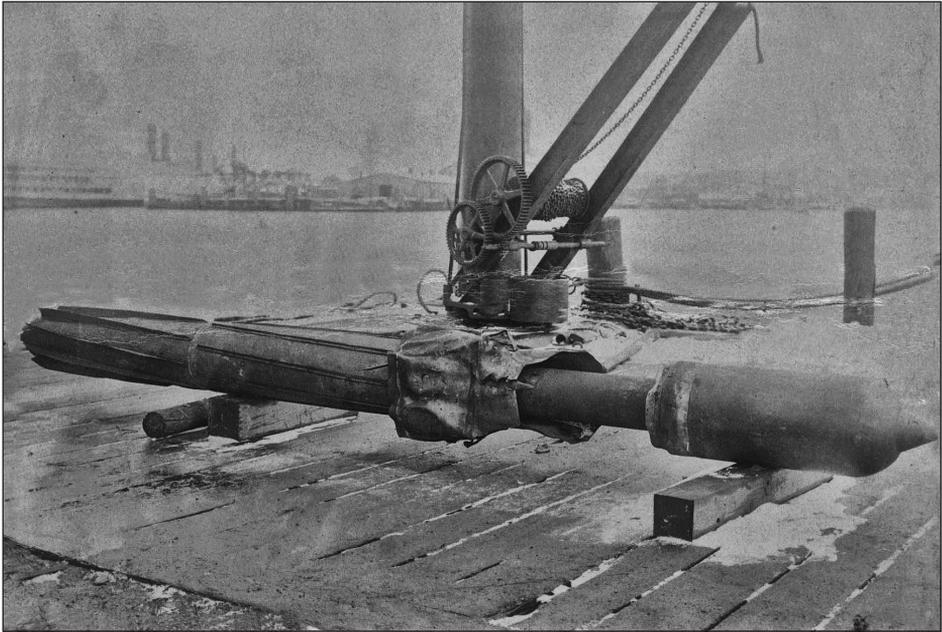
Knowing that solid-fuel rockets had erratic flight paths, a tendency to explode prematurely and that one man had been killed and several injured, during an earlier trial of Asa Weeks' 'Rocket Torpedo' at the US Naval Torpedo Station, Newport, Rhode Island; Commander G. A. Converse the President of the US Bureau of Ordnance Torpedo Board must have felt more than a little uneasy observing the July 1893 trial of Cunningham's 'Rocket Torpedo' when it breached and flew two feet above the waters off Clark's Point, New Bedford for a distance of 50 feet before re-entering the water.⁹ The torpedo was recovered the following day and it was found that the forward charge had failed to ignite. Despite these somewhat disappointing results, Converse recommended that further trials be conducted at the US Naval Torpedo Station, Newport, Rhode Island.

The first of these was held on October 31, 1893. Two Cunningham 'Rocket Torpedoes' were fired from the *Destroyer's* Ericsson Submarine Gun. Both torpedoes travelled 150 feet underwater before breaching and then travelling another 400 feet just above the surface of the water. Upon retrieval, it was found that in both cases the forward charge of the rocket had failed to ignite. By this time Converse had witnessed a total of three misfires in which the 'Rocket Torpedo's' forward charge had failed to ignite, however, he believed that the problem was not a systemic one and once again recommended further tests be conducted at the Naval Torpedo Station.¹⁰ Given, that Converse had witnessed three misfires in which the 'Rocket Torpedo's' forward charge had failed to ignite and three trial runs in which it broached it is difficult to understand why he recommended further tests and why the Bureau of Ordnance accepted his recommendation. There are at least two plausible explanations: Firstly, the United States Bureau of Ordnance was looking for a cheaper 'home grown' alternative to the Whitehead torpedo. Secondly, the Bureau of Ordnance believed that Converse's analysis was

⁸ Letter from Patrick Cunningham to The Hon. Charles S. Randall, Feb. 7, 1893, US National Archives and Records Administration, Washington, Record Group 74, Records of the Bureau of Ordnance, Entry 25, General Correspondence 1885-1903, Box 160, File #1000.

⁹ 'The New Rocket Torpedo.' *The New York Times*, July 24, 1893.

¹⁰ 'Report of Experiments with the Cunningham Rocket Torpedo.' Dated November 17th, 1893, Reference No. 1920, from Commander G. A. Converse, USN, President of the Torpedo Board, US Naval Torpedo Station, Newport, R.I., to the Chief of the Bureau of Ordnance, Navy Department, Washington, D.C. Naval Torpedo Station Papers, Box No. 136, US Naval War College Archives, West Warwick Store, Rhode Island.



■ **Figure 2** *The Cunningham Rocket Torpedo recovered from the waters of Coddington Cove, Newport, RI in December 1894. Note the extensive damage to the forward section of the outer shell. Photograph by courtesy of US National Archives and Records Administration, Washington, DC, USA.*

correct and that the faults could be traced back to a poor choice of igniters and their placement.

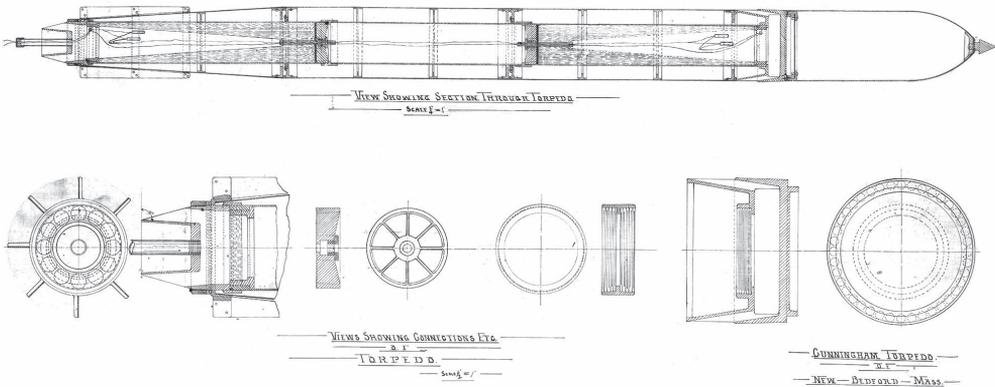
Following Converse's report the representatives of the Cunningham Torpedo Company were instructed to contact him regarding the renewal of the trials of their torpedo and on December 7, 1894, the Bureau of Ordnance appointed Torpedo Board, presided over what was to be the last trial of a Cunningham 'Rocket Torpedo' to be held at the Naval Torpedo Station, Newport, Rhode Island.

The torpedo had been somewhat modified since the October 31, 1893, trials and had been fitted with a bluffer and heavier cast iron head. Only the forward and middle charges of propellant were loaded, leaving the after section of the torpedo empty, this was intended to counteract the torpedo's tendency to breach. For the purposes of the trial the torpedo was fired from a 19 foot long wrought iron tube suspended eight feet below the surface of the water. Upon ignition, a there was a low order explosion, and the torpedo slowly travelled about 200 feet before burying itself in the mud of Coddington Cove.

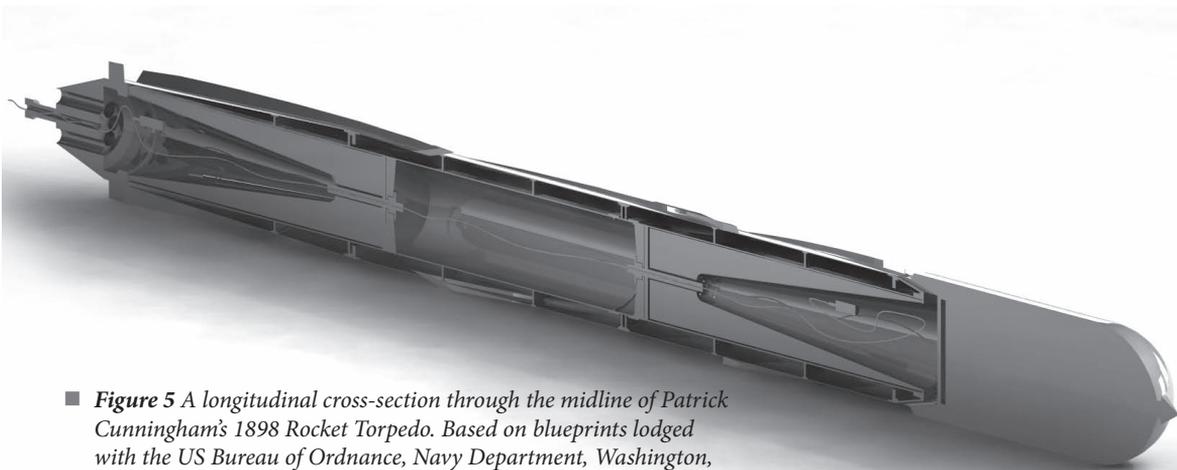
Divers recovered the torpedo the following day and it was found that the thin outer shell of the torpedo had been torn and bent back from behind the head for a distance of one to two feet. Converse was of the opinion that as the forward charge had ignited, the gases produced had been confined to the gap between the inner wall of the wrought iron tube used to launch the torpedo and the thin out-



■ **Figure 3** Patrick Cunningham's 1894 Rocket Torpedo. Based on a blueprint submitted to the US Bureau of Ordnance, Navy Department, Washington, DC, in December 1894. Copy by courtesy of US National Archives and Records Administration, Washington, DC, USA.



■ **Figure 4** Patrick Cunningham's 1898 Rocket Torpedo. Blueprint copy by courtesy of US National Archives and Records Administration, Washington, DC, USA.



■ **Figure 5** A longitudinal cross-section through the midline of Patrick Cunningham's 1898 Rocket Torpedo. Based on blueprints lodged with the US Bureau of Ordnance, Navy Department, Washington, DC in September 1898. Copy by courtesy of US National Archives and Records Administration, Washington, DC, USA.

er shell of the torpedo, crushing the shell, leaving its front edge exposed to the full force of the escaping gases while the torpedo was still in the launching tube, or just leaving it.¹¹ Converse believed that if he was correct, there was the risk of an accident if the torpedo was fired from a submerged gun under its own power.

Following December 1894's unsuccessful trial the second of the two 'Rocket Torpedoes' purchased by the Bureau of Ordnance was returned to the manufacturers. At this stage, it was thought by some that the project had died a natural death. However, three and a half years later the Chief of the Bureau of Ordnance notified the Commandant of the U.S. Naval Station, Newport, R.I., that six Cunningham 'Rocket Torpedoes' would be ready for testing in the near future and that the Bureau had agreed to purchase them providing they passed their acceptance trials.¹² The Bureau's criteria for acceptance were not particularly onerous. However, they were no longer prepared to authorize further tests at the Naval Torpedo Station. Undeterred, Cunningham's financial backers purchased the schooner *Freeman* and set about converting it into a vessel suitable for the acceptance trials.

Lieutenants Holman, Marshall and Oliver from the U.S. Torpedo Station, Newport, R.I., were to witness the trials. The first torpedo launched on September 14, 1898, breached some 150 feet from the *Freeman*, flew 10 to 15 feet above the waters of the Acushnet River, New Bedford, turned a complete somersault, and re-entered the water after travelling a total distance of 800 feet. The second torpedo also breached some 150 feet from the *Freeman*, and flew through the air for a distance of 750 feet before re-entering the water. At the request of the owners the trials were postponed until the following day. On September 15, 1898, the third torpedo launched from the *Freeman* breached almost immediately, rose in the air some 15 feet and travelled about 270 feet before re-entering the water. The fourth torpedo exploded upon ignition, sinking the *Freeman*.¹³

Patrick Cunningham and his backers had pinned their hopes on his 'Rocket Torpedo' obtaining the US Bureau of Ordnance's approval. However, this was not forthcoming. His 'Rocket Torpedo' was not the US Bureau of Ordnance's much

¹¹ Letter from Commander G. A. Converse, USN, Inspector of Ordnance, US Naval Station, Newport, R.I., Dated December 17th, 1894, Reference No. 2241, to The Commandant, U.S. Naval Station, Newport, R.I. Naval Torpedo Station Papers, Box No. 136, U.S. Naval War College Archives, West Warwick Store, Rhode Island.

¹² Letter from the Chief of the Bureau of Ordnance, Navy Department, Washington, D.C., Dated March 30th, 1898, Reference No.1000/93, to The Commandant, Naval Station, Newport, R.I. US National Archives and Records Administration, Washington, Record Group 74, Records of the Bureau of Ordnance, Entry 25, General Correspondence 1885-1903, Box 160, File #1000.

¹³ Report on the Cunningham Rocket Torpedo trials conducted at New Bedford, Massachusetts on September 14th & 15th, 1898, compiled by Lieutenants G. F. W. Holman, W. A. Marshall and J. H. Oliver of the Torpedo Station, U.S. Naval Station, Newport, R. I. Dated September 16, 1898, to The Commandant, U.S. Naval Station, Newport, R. I., US National Archives and Records Administration, Washington, Record Group 74, Records of the Bureau of Ordnance, Entry 25, General Correspondence 1885-1903. Box 160, File #1000.

sought after simple, low cost, low maintenance 'home grown' replacement for the far more expensive precision-engineered Whitehead torpedo.

Patrick Cunningham's career as an entrepreneur, businessman and inventor did not come to an end with the sinking of the *Freeman* and his failure to obtain US Bureau of Ordnance approval for his 'Rocket Torpedo'. He went on to patent a universal joint (1900), a fluid clutch (1900), a driving mechanism (1900), a boiler (1900), and a shaft-reversing device (1901).¹⁴ He retired in the early 1900's and died some twenty years later at his home in New Bedford, Massachusetts.¹⁵

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SAŽETAK

Ključne riječi: *Robert Whitehead, Whiteheadov torpedo, Patrick Cunningham, raketni torpedo, Ured za naoružanje SAD-a*

Uspješnu konstrukciju Roberta Whiteheada dobro su dokumentirali Edwyn Gray (1990.), Antonio Casali i Marina Cattaruzza (1990.), a nedavno i Benito Petrucci u svojoj monumentalnoj povijesti posvećenoj Whiteheadovoj Alenia Sistemi Subacquei (2008.). Međutim, u knjizi Nineteenth Century Torpedoes and their Inventors (Torpeda devetnaestoga stoljeća i njihovi izumitelji, 2004.) Edwyn Gray dao je uvid u začudnost i fascinaciju ratovanja torpedima u devetnaestom stoljeću. Ovaj je prilog posvećen američkom izumitelju Patricku Cunninghamu i njegovu raketnom torpedu te istraživanjima Ureda za naoružanje SAD-a u svrhu pronalazača jednostavnije i jeftinije "domaće" alternative Whiteheadovu torpedu.

¹⁴ Cunningham, P., 1900, Universal Joint, US Patent 658,499, filed April 23, 1900 and issued September 25, 1900. Cunningham, P., 1900, Fluid Clutch, US Patent 660,749, filed March 10, 1900 and issued October 30, 1900. Cunningham, P., 1900, Driving Mechanism, US Patent 660,750, filed March 10, 1900 and issued October 30, 1900. Cunningham, P., 1900, Boiler, US Patent 660,751, filed May 28, 1900 and issued October 30, 1900. Cunningham, P., 1899, Shaft-Reversing Device, US Patent 667,298, filed March 15, 1899 and issued February 5, 1901.

¹⁵ 'Inventor of the Cunningham Torpedo Dead.' *New Bedford Morning Mercury*, May 23, 1921.