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Tsushima:

A Technological Assessment

Contents.

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Introduction.

Why was the Russian Second Pacific Squadron defeated by the Japanese Combined Fleet on May 27th, 1905? Numerous reasons have been presented in the hundred years following the Battle of Tsushima. Typical Western explanations claim that the Russian ships were crewed by inferior sailors; that the Russian commanders were incompetent; and that the Russian fleet was technologically obsolete.[1] For each reason, the opposite has been argued regarding the Japanese. Thus a fictitious understandings of the battle has been constructed, portraying the Russian side as incompetent, acephalous, and technologically inept, while the Japanese are portrayed as determined, brilliant, and technologically savvy. Though a fiction, there is a point of truth to each assertion. It has been well established, for example, that crew-quality was a critical factor at Tsushima that favored the Japanese. It has also been established that the Russian fleet which steamed for Vladivostok took with it aging and in some cases obsolete warships. Certainly the Japanese commander, Togo Heihachiro, is remembered today as a sort of 20th century Nelson. The Russian commander, Zinovy Rozhestvenskii, on the other hand, has received over a century worth of criticisms for his mistakes. Suffice it to say, these simplifications do not adequately explain why the Japanese were decisively victorious at the Battle of Tsushima. I believe that the actual reason has nothing to do with the quality of crews, commanders, or the modernity of the ships involved. The answer is technological in nature, but is specific, and exclusive, to the quality of the munitions fired by the Japanese fleet. Some explanation may be required as to why ammunition quality, as opposed to all other technological factors, was decisive.

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[1] I use the term Western in its broadest sense. This paper is based on the sources available in English, and is thus strictly limited, linguistically and historiographically.

For the purpose of this study, I have identified six principle areas of naval technology for exploration. The chapter on Crews compares the manpower of the respective fleets from a technical perspective: how great of a factor was the 'quality' of the sailors involved in the battle? In the Ship Designs chapter, I provide an overview of the ships which composed the respective fleets. The following chapter on Weapons & Ammunition discusses the nature of the ordinance used by both sides. Specific attention is given to the *furoshiki* shells devised by the Japanese, which I believe were the decisive factor at Tsushima. The chapter on Armour attempts to highlight the defensive capabilities of both fleets. The chapter on Engines & Fuel discusses the mobility of the opposing fleets, including the quality of coal used by the Japanese and Russians. The final chapter, on Communications & Intelligence, considers the methods of coordinating the fleets during the battle and the use of naval intelligence prior to the battle. I conclude by stating that the Japanese were victorious at the Battle of Tsushima because the Combined Fleet possessed decisively superior ammunition in the form of the *furoshiki* shells.

Why have I chosen to analyze Tsushima? There are two reasons. Foremost, no conclusive modern analysis has yet been conducted in English with the objective of exploring both the Russian and Japanese fleets from technological and historical perspectives.[2] Secondly, I should state explicitly that I believe the Battle of the Tsushima Strait to have been the most important naval battle of modern times, eclipsing all other

[2] The most comprehensive English text covering the technology utilized by *both* sides is J. N. Westwood's *Witnesses of Tsushima*, published in 1970. As the title suggests, Westwood is more concerned with the human factor than the technological, and his analyses is accordingly incomplete. D. K. Brown's fairly recent article "The Russo-Japanese War: Technical Lessons as Perceived by the Royal Navy," published in 1993, is concerned with the evolution of naval combat following the Russo-Japanese War, rather than with the history which preceded it.

20th century naval engagements in terms of significance. In introducing his *Tsushima* in 1933, A. Novikoff-Priboy attempted to convey this significance:

> Since warships first appeared in the world, there have been many naval engagements. Only three of them, however, can rank with the Battle of Tsushima in respect of magnitude, importance, and far-reaching consequences. The first of these was the Battle of Salamis, in 480 B.C., when the fleet of Xerxes was destroyed by the Greeks. The Persian navy was enormous, whereas that of the Greeks, under the command of Themistocles, was relatively small. The second of the outstanding naval actions to which I have referred was the Battle of Lepanto, fought in the Adriatic in the year 1571. On this occasion the united fleets of the Christian powers of Europe, under Don John of Austria, inflicted a crushing defeat upon the Turkish navy, and made an end of Mohammedan sea-power in the Mediterranean. Then, at a much more recent date, in 1805, came the Battle of Trafalgar, where Admiral Nelson (who in previous sea-fights had lost an eye and an arm, and was now to lose his life) signally defeated the united French and Spanish naval forces under the French admiral Villeneuve and the Spanish admirals Gravina and Alava. Gravina perished as well as Nelson, the victor, and Villeneuve was taken prisoner. The allies lost nineteen ships to the English, the prisoners numbering twelve thousand.
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> The fourth naval action of supreme importance, the one with which this book is concerned, was fought in the Far East, near the island of Tsushima, during the Russo-Japanese War, on May 14 (O.S.) or May 27 (N.S.), 1905. To its world-wide significance I shall return in due course.[3]

Later he summarizes: "the fate of two opposing empires depended upon the outcome of this naval engagement."[4] Novikoff-Priboy's text has been criticized as a novelization of history: more concerned with telling an entertaining story than presenting facts in a systematic manner.[5] Nevertheless, Novikoff-Priboy was aboard the *Orel*, and he was quite aware of the scale of the conflict around him, and of its profound ramifications for world events. Novikoff-Priboy's introduction establishes Tsushima's place among the great naval battles of history.

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[3] A. Novikoff-Priboy, *Tsushima*, trans., Eden & Cedar Paul (New York: Alfred A. Knopf, 1944), vii-viii.

[4] Ibid., 163.

[5] Evgeny Sergeev, *Russian Military Intelligence in the War with Japan, 1904-05* (New York: Routledge, 2007), 10.

The Russo-Japanese War itself has become somewhat of a forgotten niche of 20th century history. In a recent issue of The Russian Review, John Steinberg asked the question, "Was the Russo-Japanese War World War Zero?" stressing the impact the first major conflict of the 20th century had on the course of history to follow.[6] Oron J. Hale, considered the 1905 revolution in Russia a "direct result" of the war's course and outcome.[7] The Battle of Tsushima, specifically, played a major role in determining which colonial power would triumph in the Asian Pacific. It is not a stretch of the imagination to consider Tsushima the epoch defining event of the 20th century; much as Trafalgar decidedly established British hegemony in the 19th century, Tsushima established Japanese hegemony in the Pacific. The battle could be said to have thus set in motion the events which culminated in the atomic bombing of Japan at the end of the Second World War. "The modern world was born at the turn of the last century" summarizes Constantine Pleshakov.[8] The contemporary student of history may be hesitant to rank Tsushima alongside such profoundly epoch shattering battles as Salamis, Lepanto, or Trafalgar. To meet the critical historian half-way, let it suffice to say that Tsushima brought an end to the Russo-Japanese War, and is significant for that reason if for no other.[9]

Certainly the Russo-Japanese War was a modern war. Steinberg is quite convinced that this World War Zero was a total war, "a twentieth-century phenomenon that affects every aspect of a nation's economic, cultural, and political life, and, once

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[6] John W. Steinberg, "Was the Russo-Japanese War World War Zero?" in., *The Russian Review*, vol., 67, no., 1 (January 2008), 1-7.

[7] Oron J. Hale, *The Great Illusion: 1900-1914* (Toronto: Fitzhenry & Whiteside Limited, 1971), 220.

[8] Constantine Pleshakov, *The Tsar's Last Armada* (New York: Basics Books, 2002), xv.

[9] Lynn Montross, *War Through the Ages* (New York: Harper & Row, 1960), 679.

hostilities ceased, had a transforming impact on the politics and societies of both belligerents."[10] Steinberg is careful to note that total wars are not limited strictly to the twentieth century (the Napoleonic Wars have often been described as total wars, for example), but maintains that, with regards to financing and propaganda specifically, the Russo-Japanese War resembled the wars which followed it more than the wars which preceded it. It was a nationalistic imperialist war, fought by conscript citizen-armies from both countries.[11] The rhetoric and propaganda which fueled the war was of a most modern caliber.[12]

Even though the Russo-Japanese War was the first 'modern' war, the Battle of Tsushima cannot be considered the first truly 'modern' naval battle. Tsushima marked the end of what is known as the ironclad age, a forty-five year period of naval experimentation begun in the 1860s. This period of history ended conclusively in 1905 with the Battle of Tsushima and the introduction of the revolutionary HMS *Dreadnaught*. Tsushima represented the culmination of all the technology and thought devoted to naval science since the beginning of the industrial revolution, and was firmly entrenched in that tradition.

The warships at Tsushima fought with transitionary technology which, after the battle, became almost instantly obsolete. Range-finding technology was in its infancy in 1905, and the pursuit of its development would have profound ramifications for the

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[10] Steinberg, "Was the Russo-Japanese War World War Zero?" 3.

[11] Consider Naoko Shimazu, "The Myth of the 'Patriotic Soldier': Japanese Attitudes Towards Death in the Russo-Japanese War," in, *War & Society*, vol., 19, no., 2 (October 2001), 69-89, for a detailed analysis of conscription with regards to the Japanese case.

[12] Consider Naoko Shimazu, "Patriotic and Despondent: Japanese Society at War, 1904-05" in, *The Russian Review*, vol., 67, no., 1 (January 2008), 34-49, for the Japanese case of wartime propaganda; & Rosamund Bartlett "Japonisme and Japanophobia: The Russo-Japanese War in Russian Cultural Consciousness" in., *The Russian Review*, vol., 67, no., 1 (January 2008), 8-33, for the examples from the Russian case.

accuracy and range of naval gunfire in the following decades. The airplane had yet to be incorporated into the arsenals of any of the major powers, and its presence would serve to challenge the very foundations of naval combat in the following World Wars. The completion of the *Dreadnaught* in 1906, with its steam turbine engines and "homogeneous" 12-inch armament was destined to render obsolete all the warships which had preceded it.[13] The navies of the colonial powers in 1905 required the latest technologies. Technological innovation during this time occurred rapidly and to such great effect that "ships became obsolete before they were launched."[14] This was a truism more applicable to the Russians than the Japanese in 1905, principally because the Japanese navy had been born during the industrial revolution, and was able to grown with it, rather than struggling to catch-up as was the case with the Russian navy. Indeed, the Imperial Russian Navy, like the navies of all the European powers, were spending vast sums of money to remain competitive with ships which were constantly aging. Nevertheless, the fleets engaged at Tsushima included some of the most modern warships afloat, and the myth that the Russians went into battle outfitted with totally obsolete technology must be attacked.

Richard Hough is one writer on the subject of Tsushima who has perpetuated the obsolescence myth. In 1958 his influential, *The Fleet That Had to Die* was published. This book pursues the voyage of the Second Pacific Squadron and adheres to the belief that the Russian fleet "was a collection of forty-two mainly old and all badly equipped

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[13] Bernard Ireland & Tony Gibbons, *Jane's Battleships of the 20th Century*, ed., Ian Drury (New York: HarperCollinsPublishers Inc., 1996), 100. This is not to suggest that the *Dreadnaught* rendered useless all the ships which preceded it, but rather that it so totally dominated all other battleships from a qualitative perspective that to continue producing battlesships of any other type would be a grave military error. Of course the *Dreadnaught* was certainly not a perfect ship- its armour could be penetrated at close range by the weapons mounted on older battleships, and its complete lack of secondary armament made it vulnerable to fast attack boats and submarines, for example.

[14] Montross, *War Through the Ages*, 671.

men-of-war;" and that Rozhestvenskii himself was a "frustrated and irascible aristocrat" who believed more in dieing for his Czar than in actually defeating Togo.[15] Hough's work, however, is only one among many which has caused seemingly irreparable damage to the historical legacy of the Second Pacific Squadron. Lamar Cecil followed Hough's text with his own, "Coal for the Fleet that had to Die" published in *The American Historical Review* in 1964. Therein, Cecil maintained that Second Pacific Squadron, the former Baltic Fleet, was composed of "rusty, undermanned, antiquated hulks in no condition to make steam" for Vladivostok halfway around the world.[16]

Other authors have attacked these myths. J. N. Westwood, in his *Witnesses of Tsushima*, published in 1970, proposed that the Second Pacific squadron, far from being an antiquated and obsolete fleet, actually represented, "with its repair ship, hospital ship, supply ships, and colliers," the precursor to the modern, self-contained battle fleet.[17] Extensive efforts by modern historians have been required to resurrect the legacy of both Rozhestvenskii and the Second Pacific Squadron. It is with great satisfaction thus, that Ronald H. Spector begins his recent *At War at Sea*, published in 2001, by acknowledging that the Japanese and the Russian fleets were composed of warships "which were among the most advanced in design" and that "on paper the two fleets seemed fairly evenly matched."[18] Nevertheless, I disagree with Spector's opinion that "technological determinism" cannot explain the outcome of the Battle of Tsushima. He writes that "technological determinism fails to explain… when two opposing navies employ similar technologies in the same manner, [how] one can be more successful than the other, as the

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[15] Richard Hough, *The fleet that had to die* (New York: Viking Press, 1958), ix.

[16] Lamar J. R. Cecil, "Coal for the Fleet that had to Die," in, *The American Historical Review*, vol. 69., no. 4. (July, 1964), 990.

[17] J. N. Westwood, *Witness of Tsushima* (Tokyo: Sophia University, 1970), 74.

[18] Ronald H. Spector, *At War at Sea* (New York: Viking Penguin, 2001), 1 & 7.

Japanese were against the Russians in 1904-5."[19] Spector oversimplifies the issue. His claim that there was relatively no technological disparity between the two fleets ignores the crucially important case of munitions, where the Japanese and Russians differed to decisive effect. Ultimately Spector affirms to the status quo and attributes the Russian defeat to a disparity in the seemingly unquantifiable factor of "personnel."[20]

Even texts concerned principally with technological issues, such as David Evans' and Mark Peattie's *Kaigun*, published in 1997, refuse to state explicitly any single reason for the Japanese victory. Though Evans & Peattie acknowledge that "the Japanese preponderance was primarily due to the devastating topside damage inflicted by Japanese shells" they maintain that crew quality was of equal importance.[21] Evans & Peattie affirm to the notion that leadership played as great a role as technology at Tsushima, and thus that the Russians actively lost the battle as much as the Japanese won it.[22] I contend that this kind of thinking simply reiterates conclusions which had been drawn immediately after the war, and that Evans & Peattie have failed to identify the true significance that their own conclusions allude to: specifically that the battle was won (and lost) on the issue of ammunition. All other factors are secondary. Westwood successfully arrived at this conclusion in 1970. He proposed that "if the Russian shells had had the same explosive qualities as the Japanese the outcome of the battle might, just possibly, have been different."[23] How breathtaking it is to consider that the entire course of world events

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[19] Ibid, vi.
[20] Ibid., 8.
[21] David C. Evans & Mark R. Peattie, *Kaigun* (Annapolis: Naval Institute Press, 1997), 127.
[22] Ibid., 124.
[23] Westwood, *Witness of Tsushima*, 176.

hinged on this seemingly obscure factor of munitions. Historians writing on the Battle of Tsushima have never been unwilling to credit such a singular factor.

More important than this lack of consensus among experts is how Tsushima is remembered by the public. In Nicholas Riasanovsky's textbook, *A History of Russia*, published in 2005, for example, the Second Pacific Squadron is described as an "antique fleet" with no reason given beyond the fleet's supposed antiquated nature for the Russian defeat.[24] The uninformed reader would believe, naturally enough, that the Russians were defeated by their general technical obsolescence- a conclusion which is both untrue and needless. Along the same lines, Peter Duus' textbook, *Modern Japan*, published in 1998, considers the Second Pacific Squadron "incredibly inept" leaving the reader to draw similarly false conclusions regarding the nature of the Russian defeat.[25] Other examples abound, but this paper is only superficially concerned with pedagogy.

[24] Nicholas V. Riasanovsky & Mark D. Steinberg, *A History of Russia*, 7th ed. (New York: Oxford University Press, 2005), 375.

[25] Peter Duus, *Modern Japan*, 2nd ed. (Boston: Houghton Mifflin Company, 1998), 145.

The Battle.

The Battle of Tsushima was the only decisive naval engagement fought between fleets of ironclad battleships. The only other major engagement involving two fleets composed primarily of battleships was the indecisive conflict between the Royal Navy's Grand Fleet and the Second Reich's High Seas Fleet off the coast of Jutland in 1916. All subsequent major fleet engagements were decided not by battleships, but by aircraft carriers. Tsushima thus represents a specific historical-technological epoch, one never to be repeated after 1905. The battle of Tsushima was fought from approximately 1:30 in the afternoon of May 27th to 10:50 in the morning on the 28th, 1905, when the last Russian ships surrendered.[26] The events in the straits of Tsushima occurred less then five months short of October 21st 1905, the one hundredth anniversary of the Battle of Trafalgar.

The Japanese fleet was the Combined Fleet, led by Admiral Togo Heihachiro. Togo was a hereditary *bushi*, descended from a family of *samurai* owing fealty to the Satsuma *daimyo*. Togo had been sent to Britain to receive officer training in February of 1871.[27] He returned to Japan, was promoted to the rank of captain, and distinguished himself as a naval commander during the Sino-Japanese War, with the result of his promotion to the rank of Rear Admiral.[28] He was chosen to lead the Combined Fleet at the outbreak of the Russo-Japanese War.

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[26] Pleshakov, *The Tsar's last armada*, 284.

[27] Noel Busch, *The Emperor's Sword* (New York: Funk & Wagnalls, 1969), 33.

[28] A war in which "he had been the first Japanese officer to fire a shot". David Walder, *The Short Victorious War* (London: Hutchinson & Co Ltd., 1973), 58. "Togo participated in this campaign with distinction" in Pleshakov, *The Tsar's last armada*, 32. On his promotion to Rear Admiral, Busch, *The Emperor's Sword*, 56.

The Russian fleet was the Second Pacific Squadron and was led by Admiral Zinovy Rozhestvenskii. Rozhestvenskii's father had been a military doctor, and through that position Rozhestvenskii had managed an enlistment in the Russian Naval Academy.[29] After graduation he specialized in artillery training, and "then got involved in testing guns, shells, and armor as a member of the Artillery Committee."[30] He participated in the Russo-Turkish War of 1877-8, and after organizing the training regime for the new Bulgarian Navy, and serving as an attaché in Britain, he was promoted to Read Admiral.[31] It was 1898, and over the following years Rozhestvenskii would gain the favor of the Czar. In 1903 the Czar appointed Rozhestvenskii to the position of Head of Naval General Staff.[32] Praised for his incorruptibility and iron command, Rozhestvenskii was chosen as the natural leader for the Second Pacific Squadron.[33] On September 28th, 1904, he had been dispatched, along with the latest warships built in Russia, to relieve the First Pacific Squadron then blockaded at Port Arthur by Togo.

Port Arthur had been under siege from the Japanese Army since the beginning of June, 1904. At incredible human cost, the Japanese pushed to capture the critical 203 meter hill, overlooking Port Arthur. The battle for Hill 203 was of a kind easily comparable to the warfare which developed in Western Europe following the solidification of trench-lines in 1915.[34] Hill 203 fell on December 6th, giving the Japanese the position they required to observe the fall of their heavy artillery upon Port Arthur. The Japanese guns proceeded to make quick work of the trapped First Pacific Squadron.

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[29] Pleshakov, *The Tsar's last armada*, 39.
[30] Ibid., 40.
[31] Ibid., 50.
[32] Ibid., 53.
[33] Ibid., 37.
[34] Busch, *The Emperor's Sword*, 77.

The remaining Russian forces in Port Arthur surrendered on January 2nd 1905. The situation was now dire for Russia- only by gaining command of the sea and cutting off Japan's reinforcements could the Russians hope to stop the Japanese advance into Manchuria.

When Port Arthur fell the Second Pacific Squadron was waiting at Nossi-Be in Madagascar to meet with Rear Admiral Dimitri von Felkerzam's cruiser detachment. Felkerzam had sped his ships through the Suez Canal while Rozhestvenskii took the bulk of the squadron around the Cape of Good Hope. Reformed into a single fleet, Rozhestvenskii and the baron von Felkerzam were ordered, in light of the destruction of the First Pacific Squadron, to make for Vladivostok, the last Russian naval base on the Pacific. Furthermore, Rozhestvenskii was informed that another fleet was being dispatched from the Baltic to reinforce him. This haphazard squadron, composed of an old armoured cruiser, three coast defense ships and a pair of new cruisers, was titled the Third Pacific Squadron. Under Rear Admiral Nebogatov, the Third Pacific Squadron met Rozhestvenskii at Cam Ranh Bay, French Indo-China, on May 8th 1905. Admiral Felkerzam, who had been ill for some time, died on May 11th, leaving Nebogatov second in command.[35]

So it was that on the evening of May 26th, 1905, the complete Second Pacific Squadron, having traveled over 18,000 miles and steamed for seven and a half months, attempted to force a passage through the Sea of Japan and reach Vladivostok.[36] Visibility was initially low, mist and haze obscured the straits of Tsushima. Admiral Togo,

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[35] Nebogatov, for reasons of morale and secrecy, was not informed of Felkerzam's death, and was thus unaware that at the time of the battle he was indeed the second in command. Bosch claims that Felkerzam had died on the 25th. Busch, *The Emperor's Sword*, 158.

[36] Spector, *At War at Sea*, 5. See Appendix (A) for a map of the voyage.

informed by his scouts that the Second Pacific Squadron was on its way towards the straits, made steam from his Korean base at Masan to intercept Rozhestvenskii. The two fleets became engaged on the afternoon of the 27th, and by the morning of the next day it was clear that the Japanese had been victorious.

The events of the battle have been told and retold numerous times. While details often differ, there are few major points of contention. I begin this version by quoting Evans & Peattie, who describe the famous unfurling of the Z flag aboard the *Mikasa*.

> After signaling for battle speed, 15 knots, at 1355 [1:55] Togo unfurled his famous Nelsonian signal, the Z flag: [Japanese text]… (*The fate of the empire rests upon this one battle; let every man do his utmost*). He then turned westward and held course for a few minutes. The two fleets were now about 6 miles (11,000 meters) apart, the Russians coming on at their battle speed of 10 knots."[37]

Togo's Combined Fleet was now steaming directly towards the Russian squadron, which was then divided into two lines. The Combined Fleet would have proceeded to pass the Second Squadron, resulting in an indecisive engagement, had not Togo, fixated on totally annihilating the Russians, ordered his fleet to turn and maneuver alongside Rozhestvenskii's line on a parallel trajectory.[38] Known as 'the Turn' this maneuver was at once the most daring and ultimately successful maneuver of Togo's career.[39] While his Combined Fleet was making this "U-turn" it meant that each ship would be briefly exposed to Russian gunfire without the ability to return fire.[40] However, once the turn had been completed, the Combined Fleet would be able to use its superior speed to overtake the Second Pacific Squadron and force it off its course for Vladivostok. Rozhestvenskii would be forced to fight if he intended to escape. Of course, the *Mikasa* and Togo along

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[37] Evans & Peattie, *Kaigun*, 118. Italics added.
[38] Ibid.
[39] See Appendix (B) for a map of the battle showing 'the Turn'.
[40] Busch, *The Emperor's Sword*, 147.

with it, would have to survive long enough to exact such a fate upon the Russian squadron, and while the Japanese were turning they were wholly vulnerable.

Seeing his opportunity, Rozhestvenskii ordered firing. A hurricane barrage commenced. These opening salvoes scored 16 hits on the *Mikasa* in rapid succession, destroying the ship's wireless antenna and inflicting numerous casualties.[41] These shots were fired from the *Suvorov*, *Alexander III* and the *Borodino*, as the rest of Rozhestvenskii's fleet was still forming into a single line.[42] Eventually the line solidified and started firing. Aboard the battleships *Orel*, Novikoff-Priboy describes "the whole ironclad" shaking as the heavy guns fired.[43] As the "sea around the *Mikasa* churned with Russian shells," the Japanese flagship became so obscured from shell splashes that only a further three hits were scored in the following ten minutes.[44] Nevertheless, the Russian gunfire was causing some telling damage. The *Yakumo*'s forward turret had been damaged, while the steering gear on the *Asama* was destroyed.[45]

Despite these setbacks, the Japanese had yet to return fire in any concentrated manner. The battleships *Mikasa*, *Shikishima*, *Fuji*, and the *Asahi* slowly completed their turns. The armoured cruisers *Kasuga*, *Nisshin*, *Idzumo*, *Yakumo*, *Asama*, *Azuma*, *Tokiwa* and *Iwate* followed.[46] These twelve ships proceeded to concentrate their fire upon the *Suvorov* and *Oslyabya*, the flagships of the First and Second divisions of Rozhestvenskii's fleet.[47] Togo ordered "normal" firing against the Russians at 2:11, and

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[41] Busch, *The Emperor's Sword*, 150. Pleshakov, *The Tsar's Last Armada*, 269.
[42] Pleshakov, *The Tsar's Last Armada*, 269.
[43] Novikoff-Priboy, *Tsushima*, 156.
[44] Ibid.
[45] Spector, *At War at Sea*, 16.
[46] Westwood, *Witnesses of Tsushima*, 180.
[47] Ibid.

then "rapid" firing at 2:18.[48] The battle at this point became quite intense, both sides trading salvoes in rapid succession.

Realizing the danger of his position, Rozhestvenskii attempted to open the range between the two fleets. Togo would not allow this, and his advantage in speed allowed him to maintain pressure on the Russian line. The Japanese continued "closing and punishing the *Suvoroff* in her upperworks and batteries, starting fires, scouring unprotected positions with a hail of splinters from shell fragments".[49] Rozhestvenskii himself was wounded in the head as the Japanese barrage continued. The *Osliabia* was having the worse of it, however: the battleship's upperworks had already been devastated when the ship suffered a critical hit which opened up the hull and cut the power to its forward turret.[50] Three successive 12-inch shells fired from the *Asahi* struck its hull, and the *Osliabia* capsized shortly thereafter at 3:30.[51] The *Suvarov*, badly damaged and still carrying the wounded Rozhestvenskii, proceeded to steam out of control.[52] With two flagships now effectively lost, and Rozhestvenskii himself incapacitated there was little doubt that the Japanese would win. Nevertheless, the Second Pacific Squadron was far from combat ineffective, and the battle continued.

As the evening progressed, visibility was significantly reduced due in large part to the fires burning aboard the Russian ships. It also seems that the mist and haze which had reduced visibility during the morning gave way to a thicker fog. The Japanese and Russian lines reformed, and when they next encountered each other the gunnery duel was

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[48] Evans & Peattie, *Kaigun*, 119.

[49] Padfield, *The Battleship Era* (London: Granada Publishing Ltd., 1972), 177. See Appendix (C) for a map of the battle following 'the Turn'.

[50] Ibid.

[51] Spector, *At War at Sea*, 19.

[52] Evans & Peattie, *Kaigun*, 120.

continued. The *Borodino* and the *Orel* had taken the leading position, followed by the Third Division under Nebogatov.[53] Togo concentrated his fire upon the *Borodino*. Four hours later the ship was just "a burning shell."[54] The *Orel* was suffering a similarly intense barrage, and numerous fires had broken out on the decks of the battleships.[55] Then, "around 6:30" the *Alexander III*, which had been trailing the Russian division in a crippled state, capsized. The *Borodino*, suffering a hit from the *Fuji* which set off the battleship's magazine proceeded to explode at 7:12.[56] Earlier the Japanese had attempted to sink the damaged *Suvarov*, by attacking it with torpedo boats and destroyers, but the Russian flagship remained afloat.[57]

As night fell, Togo again sent his torpedo boats and destroyers into action. The Fourth Destroyer Flotilla, specifically, attacked and destroyed several Russian ships during the night and early morning of the 27th and 28th. At 8:20 the evening of the 27th the *Suvarov* was finally torpedoed and sunk, though the injured Rozhestvenskii had long since been transferred to the Russian destroyer *Bedovy*.[58] At 2:30 the next morning Japanese destroyers found the badly damaged *Navarin* and sunk it by spreading mines across the turret-ship's bow.[59] The Fourth Destroyer Flotilla also repeatedly launched torpedo attacks against the *Sisoi Veliky*, but the battleship remained afloat until it was scuttled along with the *Admiral Nakhimov* to avoid capture.[60] Nebogatov and the remainder of his Third Pacific Squadron were eventually overtaken by Togo's fleet.

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[53] Ibid., 122.

[54] Pleshakov, *The Tsar's Last Armada*, 278.

[55] See Appendix (D) for a picture of the *Orel*'s decks after the battle.

[56] Ibid, 279. Robert Gardiner, et all, *Conway's All The World's Fighting Ships: 1860-1905*, eds., Roger Chesneau & Eugene M Kolesnik (London: Conway Maritime Press, 2002), 221.

[57] Pleshakov, *The Tsar's Last Armada*, 276.

[58] Evans & Peattie, *Kaigun*, 122.

[59] Ibid.

[60] Busch, *The Emperor's Sword*, 177.

Realizing his situation to be hopeless, Nebogatov, with little ammunition remaining, surrendered. Rozhestvenskii, aboard the *Bedovy*, was also captured shortly thereafter.[61]

> The fates of the remaining ships were diverse: some went down firing their guns, others were run aground or scuttled or were interned in neutral ports, some simply surrendered. The *Izumrud*, which had escaped when Nebogatoff surrendered, ran on the rocks in Vladimir Bay, and became a total wreck, a stone's throw from Vladivostock. Only the cruiser *Almaz* and two destroyers, the *Bravy* and the *Grozny* reached that port intact.[62]

Indeed, the Combined Fleet had succeeded in quite totally annihilating the Second Pacific Squadron. Six battleships had been lost, the *Osliabia* and *Alexander III* had been sunk by shellfire, the *Borodino* by a magazine explosion, and the *Suvarov* from torpedoes.[63] The *Sisoi Veliky* had been scuttled and the *Orel* captured.[64] The Japanese had lost three torpedo boats. 110 Japanese were killed, while 4,830 Russians had died.[65] 590 Japanese were wounded.[66] The Japanese also captured "almost 6000" (5,917) prisoners, "many of them wounded".[67] Lastly, 1,862 Russian sailors and officers were interned at neutral ports after the battle.[68] 146,900 tons of warships had been sunk, while 58,600 tons were captured. In sum, 205,500 tons were lost at Tsushima, more than the 171,700 tons sunk eleven years later at Jutland.[69] Indeed, in terms of tonnage lost Tsushima ranks second among the largest naval battles of all time- surpassed only by the vast Leyte Gulf campaign fought between Japan and the United States during the Second World War.

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[61] Evans & Peattie, *Kaigun*, 122.

[62] Walder, *The short victorious war*, 286. The entire Japanese official account can be read here: <http://www.russojapanesewar.com/sea-of-japan.html>

[63] Ireland, *Jane's Battleships of the 20th Century*, 90.

[64] Evans & Peattie, *Kaigun*, 180.

[65] Ibid., 124.

[66] Walder, *The short victorious war*, 286.

[67] Busch, *The Emperor's Sword*, 203. The exact number is from Evans & Peattie, 124.

[68] Walder, *The short victorious war*, 286.

[69] Hough, *The fleet that had to die*, 209.

Ship Designs.

This chapter will discuss the composition of the respective fleets. I restrict my analyses here to capital warships only- for reasons of space it would be quite impossible to discuss all the varieties of torpedo boats and destroyers, not to mention supply ships, transports and auxiliaries involved in the battle.[70]

The warships which fought at Tsushima were classified into four primary categories: battleships, armoured cruisers, protected cruisers, and unprotected cruisers. At the center of the battlefleet, characteristically, were the 'ironclad' battleships. The term 'ironclad' had become somewhat anachronistic by 1905, being a reference to the first days of iron armouring where the armour plates were applied directly over the hull of otherwise wooden ships. Bernard Brodie, in his *Sea Power in the Machine Age* explains that a significant period of time elapsed between the invention of naval armour plate and the introduction of iron ship manufacturing.[71] As such, the term 'ironclad' outlasted the wooden ship altogether and persisted into the era of all iron ship construction. In 1905, the battleships of Japan and Russia were some of the most complicated (and expensive) machines ever constructed. The battleships were the largest ships, crewed by the greatest number of seamen, made mobile by the most powerful engines and outfitted with the heaviest guns and armour. The ironclad battleship was a formidable island fortress, displacing 15,000 tons of seawater or more, and often capable of steaming at speeds upwards of 18 knots.

The armoured cruiser followed in this classification hierarchy. Carrying smaller but faster firing guns and less armour, the armoured cruisers could steam at greater

[70] See Appendix (E) for a complete list of the respective divisions.

[71] Bernard Brodie, *Sea Power in the Machine Age* (New York: Greenwood Press, 1969), 128. Consider also the section on Armour below.

speeds than the battleships. The armoured cruisers, as the name implies, were designed to provide a middle ground between the unarmoured 'cruisers' of the fleet, and the heavily armoured battleships. Armoured cruisers, taking advantage of their superior speed and rapid firing guns, could steam along with the battleships in the battle line, adding their firepower to the line's formation. These ships could also be detached to pursue lightly armoured or damaged ships independently. Generally the armoured cruisers were classified along with the battleship as 'armoured capital ships' to distinguish them from the unarmoured cruisers of the fleet.[72] These were the so-called 'protected' and 'unprotected' cruisers. Brodie writes that protected cruisers characteristically "carried no side armor but had a thin plate of curved armor set like an inverted saucer over the engines and other vital parts."[73] Without side armour these ships were vulnerable to heavy gunfire, and were not intended to stand against or alongside true armoured ships. These cruisers were designed to raid merchant shipping lanes, scout for the main battlefleet, or provide screening against torpedo boat or destroyer attacks. 'Unprotected cruisers' were often little more than converted merchant ships, outfitted with a few deck guns and tasked with the similar roles: scouting, screening, raiding, and so on.

The Second Pacific Squadron was built around a core of five first class battleships. The four ships of the 15,000 ton *Borodino* class represented the latest products of Russian naval engineering. Rozhestvenskii's flagship was among these: the *Knaiz Suvarov* (completed in September 1904). The other three ships of the *Borodino* class were the *Alexander III* (September 1904), *Orel* (October 1904), and *Borodino* (August 1904). The fifth first class battleship was the *Osliabia* (12,683 tons

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[72] Gardiner, et all, *Conway's All The World's Fighting Ships*, foreword.
[73] Brodie, *Sea Power in the Machine Age*, 174.

displacement, completed 1901) from the *Peresviet* class.[74] These ships had been ordered as part of the navy's expansion plan undertaken between 1897 and 1903.[75] Novikoff-Priboy described his experience being transferred from the cruiser *Minin* to the *Orel*.

> The battleship *Oryol* seemed to me a giant in comparison with the cruiser *Minin*. The first thing that struck me was its enormous size. It was painted black, not only the armour-plate that invested the hull, but the superstructure as well. There were twin turrets fore and aft, armed with 12-inch guns, and three turrets on either beam, carrying 6-inch guns. The muzzles of these guns gave an impression of formidable strength. Two stages higher was a battery deck furnished with 75-millimetre quick-firing guns to deal with torpedo-boats. Upon the upper deck were the bridges, the fore-ridge having three storeys and its middle the conning-tower, and the after-bridge two storeys. At either end of the bridges were smaller (47-millimetre) quick-firing guns, and electric searchlights. Two huge funnels, painted yellow, towered amidships. Between these were boats, steam-pinnaces, and torpedo-tubes. The antenna of the wireless outfit ran from the main-top to mizzen-top.[76]

The hulls of these battleships were protected by the newly developed Krupp-Cemented (KC) armour. The Russian battleships were made mobile by duel shaft Vertical Triple Expansion engines capable of 16,300 horsepower and at least 17 knots (18-19 knots in the *Osliabia*).[77] The design for the Borodino class had been heavily influenced by the French designed and built precursor, the *Tsesarevich*. Built at the La Seyne yards in France the *Tsesarevich* design had proven to be quite successful. Westwood believes that the *Borodino* class should "be considered as at least the equal of their contemporaries in

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[74] Novikoff-Priboy, *Tsushima*, Appendix, 412. & Gardiner, et all, *Conway's All The World's Fighting Ships: 1860-1905*, 182 & 184. The ships of the Borodino class were originally rated at 13,516 tons.

[75] Gardiner, et all, *Conway's All The World's Fighting Ships*, 172.

[76] Novikoff-Priboy, *Tsushima*, 7. See Appendix (F) for a picture of the *Orel* before the battle.

[77] Gardiner, et all, *Conway's All The World's Fighting Ships: 1860-1905*, 182 & 184. The *Osliabia's* engines, according to *Conway's,* could produce 15,000 horsepower.

other navies."[78] Certainly these were formidable warships. 835 sailors and officers served aboard each *Borodinos*, and 752 men served aboard the *Osliabia*.[79]

More must be said of the *Osliabia*, for this ship with high walls stood out amongst the slower *Borodino* class on account of its lighter armament, lower displacement, but higher speed. The *Osliabia* was armed with 10-inch rather than 12-inch guns, and Westwood considers the *Osliabia* some form of proto-battlecruiser. It seems that the ship's designers had attempted to build a ship halfway between an armoured cruiser and a battleship.[80] As it happened, the *Osliabia*, saddled in a squadron with several slower ships, was not able to take advantage of its advanced design with regards to speed.

Three of these slower ships were the second rate battleships, *Sissoi Veliki* (completed 1896, 10,400 tons), *Nicholas I* (completed 1891, 9,672 tons), and *Navarin* (completed 1896, 10,206 tons).[81] Of these three, only the *Sissoi Veliki* could be described as a true battleship, the *Navarin* and the *Nicholas I* were really turret-ships; basically floating gun batteries mounting pairs of 12-inch guns in fore and aft turrets (the *Nicholas I* carried only a forward turret).[82] All three ships were slower than the first rate battleships: none of these second rate ships could steam faster than fifteen-and-a-half knots.[83] The *Navarin* was crewed by 622 men; 611 on the *Nicholas I* and 586 on the *Sissoi Velik*.[84]

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[78] Westwood, *Witness of Tsushima*, 14.
[79] Gardiner, et all, *Conway's All The World's Fighting Ships: 1860-1905*, 182.
[80] Westwood, *Witnesses of Tsushima*, 13.
[81] Gardiner, et all, *Conway's All The World's Fighting Ships*, 178-80.
[82] Novikoff-Priboy, *Tsushima*, 412.
[83] Gardiner, et all, *Conway's All The World's Fighting Ship*, 178-80.
[84] Ibid.

The Combined Fleet was built around four battleships, all constructed in Britain. These ships were, the *Fuji* (12,533 tons, completed 1897), the *Shikishima* (14,850 tons, completed 1900), the *Asahi* (15,200 tons, completed 1900) and Togo's flagship, the *Mikasa* (15,140 tons, completed 1902).[85] The *Fuji* had been built to resemble the ships of the United Kingdom's *Royal Sovereign* class, while the remaining three battleships were derived from the design of the *Majestic* class.[86] Each ship was outfitted with the latest improvements at the time of its construction, yet as a whole maintained a remarkable homogeneity. Specifically, these battleships were uniformly armed, and capable of reaching the same maximum speed.[87] The *Mikasa* was regarded at the time of its construction as one of the best warships in the world. 637 sailors and officers served aboard the *Fuji*, 836 aboard the other battleships.[88] These four ships had survived several engagements, including the inconclusive Battle of the Yellow Sea on the July 28th 1904. Two sister battleships, the *Hatsuse* and the *Yashima* had been lost to mines on May 15th 1904- a secret the Japanese had attempted to conceal for as long as possible. Indeed, the events of the 15th had dropped Togo's battleship strength by a third.

However, these losses were not as dire as they could have been. Under the leadership of Yamamoto Gombei, the chief of the Naval Affairs Bureau, the Imperial Japanese Navy had insisted that the any naval expansion plan undertaken by Japan be towards a "*balanced* fleet."[89] Yamamoto sought to devise a fleet capable of responding

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[85] Gardiner, et all, *Conway's All The World's Fighting Ships: 1860-1905*, 221-222. The *Mikasa* is today preserved as a Museum ship, and can be visited at Yokosuka. See Appendix (G) for a picture of the *Mikasa* as it appeared in 1905.

[86] Evans & Peattie, *Kaigun*, 60. "All mounted four 12-inch and fourteen 6-inch guns, and could reach 18 or 19 knots."

[87] Westwood, *Witness of Tsushima*, 30.

[88] 830 in the case of the *Mikasa*. Gardiner, et all, *Conway's All The World's Fighting Ships*, 221-2.

[89] Evans & Peattie, *Kaigun*, 60. Italics in original.

and adapting to wartime catastrophe, such as that which afflicted the Combined Fleet on the 15th of May.[90] To achieve his goal, Yamamoto insisted that the navy purchase from abroad six armoured cruisers: these six ships were the *Asama* (1899, 9,700 tons), the *Tokiwa* (the same), the *Iwate* (1901, 9,750 tons), the *Idzumo* (1900, 9,750 tons), the *Adzuma* (1900, 9,307 tons), and the *Yakumo* (1900, 9646 tons). The *Yakumo* was built in Germany at the Vulcan works, while the *Adzuma* was built at St. Nazaire in France.[91] The remaining four armoured cruisers were all built by Armstrong at the Elswick yards in England.[92] Two more armoured cruisers were also acquired from the Argentine navy, renamed the *Kasuga* (1904, 7,628 tons) and the *Nisshin* (the same), these ships were built by the Italian Ansaldo yard.[93] At Tsushima the armoured cruisers were led by Admiral Kamimura, flying his flag from the *Idzumo*. Evans and Peattie describe these ships: "The cruisers were fast, maneuverable warships armed completely with Elswick quick-firing guns (8- and 6-inch) and were amply protected above and below the waterline (with Harvey nickel steel for the *Azuma*, and KC steel for the *Izumo* and *Iwate*)."[94] These ships could easily steam at over 20 knots. Crew compliments ranged from a high of 726 aboard the *Asama* and *Tokiwa*, to a low of 600 aboard the *Kasuga* and *Nisshin*.[95] At Tsushima, Togo employed his armoured cruisers in the battle line, directly behind his battleships. This was simultaneously advantageous and risky, for while the armoured cruisers could then add their quick-firing guns to the weight of the Japanese broadside, they would also

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[90] Ibid.
[91] Evans & Peattie, *Kaigun*, 62. Gardiner, et all, *Conway's All The World's Fighting Ships*, 224-6.
[92] Gardiner, et all, *Conway's All The World's Fighting Ships*, 224-5.
[93] Ibid., 226.
[94] Evans & Peattie, *Kaigun*, 62.
[95] Gardiner, et all, *Conway's All The World's Fighting Ships*, 224-6.

be exposed to shellfire against which their armour could provide only partially adequate protection.

The Second Pacific Squadron included only three true armoured cruisers: the *Admiral Nakhimoff*, *Vladimir Monomakh*, and the *Dmitri Donskoy*. These ships were the oldest warships in the second pacific squadron. The *Nakhimoff* displaced 8,500 tons, and was crewed by 570 seamen. Construction of this ship had begun in 1884 and, coming from a different generation of warships, could only manage 17 knots (slow for an armoured cruiser) despite the installment of newer boilers in 1899.[96] The *Monomakh* and *Donskoy* had both been completed in 1885, and, indicative of their age, were fitted with full sailing rigs.[97] Though both ships were modernized in the 1890s to improve their weaponry (and remove the sails) they remained slow and vulnerable under steam, capable of only 15 to 16 and a half knots.[98] All three ships were thus outclassed- and outnumbered- by Togo's newer armoured cruisers. This disparity in armoured cruisers was not remedied by the arrival of the Third Pacific Squadron, with its coast defense ships. Nor did the presence of the protected cruisers, *Oleg*, *Aurora*, and the *Svetlana*, serve to equalize the disparity. Though these protected cruisers were quite new, they were no match for the armoured cruisers of the Combined Fleet. Indeed, the *Svetlana* had once been the private yacht of Grand Duke Alexei.[99]

So far I have described the most powerful warships of each fleet, however, both fleets included many older and in some case obsolete warships. The Second Pacific Squadron, particularly, has often been described as chocked full of obsolete ships, and it

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[96] Ibid., 188.

[97] Ibid., 186-7.

[98] Ibid.

[99] Ibid., 193. The *Aurora* will be remembered for its role in starting the October Revolution. The ship is preserved today as a museum outside St. Petersburg.

is this claim which has perhaps gone the farthest to perpetuate the myth of Russian obsolescence. Novikoff-Priboy went as far as to consider only the *Borodino* class as "up-to-date" labeling all the other ships of the squadron as "obsolete types".[100] In reality the Second Pacific Squadron contained only three truly obsolete ships: the three armoured cruisers described above. Rozhestvenskii, for his part, had railed against the inclusion of these ships which were popularly considered the "self-sinkers" due to their obsolete nature.[101] The Third Pacific Squadron has received particularly heavy criticism. For example, a New York Times article from February 20th 1905, announced the news that the Third Pacific Squadron was steaming to meet with Rozhestvenskii, and that the ships under Nebogatov were "fit for nothing but a museum."[102] Pleshakov describes the Third Pacific Squadron as "old, poorly armed, and slow."[103] I have already mentioned the *Nicholas I*, which was Nebogatov's flagship. This ship, criticized as obsolete, was deemed sound enough for inclusion into the Japanese Navy as the *Iki* after Nebogatov had surrendered it.[104] The other four ships of Nebogatov's Third Pacific Squadron were the sister ships of the *Admiral Ushakov* class, and the *Vladimir Monomakh*. The latter was detached and moved to Admiral Enquist's cruiser squadron.[105] The *Ushakov*s, built in the 1890s and capable of 16 knots, were fairly modern and swift, only a knot slower then the battleship's of the *Borodino* class.[106] Mainly these ships were small: they had

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[100] Novikoff-Priboy, *Tsushima*, 163.

[101] Hough, *The fleet that had to die*, 113 & 115. The turretships of the Third Pacific Squadron were also known as "'the galoshes' or 'flatirons.'"

[102] New York Times, "Coast Defense Ships Sail to Fight Japan," February 20, 1905. The article mistakenly claims that several truly obsolete ships from the Baltic Fleet also sailed with Nebogatov, which was not the case.

[103] Pleshakov, 136.

[104] Gardiner, et all, *Conway's All The World's Fighting Ships*, 178.

[105] Vladimir Semenoff, *The Reckoning*, trans., L. A. B. (London: John Murray, 1909), 448.

[106] Ibid., 181.

been designed to counter recent Swedish acquisitions and defend the Russian coast, and were never designed to fight against true battleships.[107] None of these ships displaced more than 5,000 tons, and all were armed with 10-inch gun turrets, the same as was fitted aboard the *Osliabia*.[108] The inclusion of these coast defense ships was a mixed blessing- their guns were certainly a welcome addition, but they were no substitute for the armoured cruisers the Russians desperately required. Nevertheless, the rhetoric surrounding the Third Pacific Squadron's obsolescence is essentially fictitious. As mentioned, the oldest ships in Rozhestvenskii's fleet were actually his armoured cruisers, and there were only three of these.

The Combined Fleet actually included more aged ships: the most notable of these being the three protected cruisers the French had built for Japan at the beginning of the 1880s for the Sino-Japanese War. Laid down in 1888 and all displacing 4,217 tons, these were the *Itsukushima*, *Matsushima* and the *Hashidate*.[109] These ships had proven only partially successful during that war, but had been re-fitted with new, larger boilers to improve their speed.[110] The principle armament each of these protected cruisers mounted, a single 12.6-inch cannon, had proved unwieldy and cumbersome at the Battle of the Yalu, being both vulnerable to sell-fire and slow when reloading.[111] The *Naniwa* and the *Takachiho*, both aging protected cruisers were, "the first protected cruisers built for the Japanese Navy".[112] Built in 1884, these ships had been modernized and refitted so they

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[107] Ibid., 181.
[108] Novikoff-Priboy, *Tsushima*, 412.
[109] Gardiner, et all, *Conway's All The World's Fighting Ships*, 227.
[110] Ibid.
[111] Evans & Peattie, *Kaigun*, 49.
[112] Gardiner, et all, *Conway's All The World's Fighting Ships*, 226.

could steam at 18 and a half knots.[113] Another dated ship was the *Idzumi*, built by England for Chile and acquired by Japan in time for the Sino-Japanese War.[114] The *Chen-yuan*, captured victory spoils from that 1895 war, also took part in the battle. This powerful German constructed turret-ship had been built in 1882. The Japanese re-armed it with four modern 12 inch guns.[115] These ships were all of mixed quality. Refitting extended their service life, but many, such as the *Itsukushima*, *Matsushima* and the *Hashidate*, had only been partially successful ten year before the Russo-Japanese War, and by 1905 were ill-suited to fleet combat.[116]

To summarize, the two fleets were relatively equal in terms of the quality of their first rate warships. The Russians outnumbered the Japanese in terms of battleships, and could thus be expected to win in a major fleet engagement, but the Japanese did substantially outnumbered the Russians with regards to armoured cruisers. The Russians, despite the rhetoric, only possessed three truly aged warships, but these did serve to lower the overall speed of Rozhestvenskii's fleet from 18 knots (the speed at which his battleships could steam) to around 15, at best. In battle, the Second Pacific Squadron only managed about 10 knots, but the reasons for this are not to be attributed even to Rozhestvenskii's oldest and slowest warships.[117]

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[113] Ibid.

[114] Ibid., 228.

[115] Ibid., 220.

[116] Aboard the *Orel*, Novikoff-Priboy described these warships, which together comprised the Japanese Fifth Division, as "out of date". Novikoff-Priboy, *Tsushima*, 145.

[117] Consider the chapter on Engines & Fuel for more information.

Crews.

In 1906, Seaton Schroeder, writing for the U. S. Naval institute, attempted to explain why the Russians had lost the battle. In his article, *Gleanings from the Sea of Japan* he identified the principle dichotomy which all subsequent debate on the topic of Tsushima pursued: men versus machines. Early analysis of the battle tended to presume that the two fleets were technologically of great similarity. The largest variable between the Japanese and Russians ships, it was thought, was not technological at all, but was instead the quality of the respective sailors and officers. As to why the Japanese were victorious, Schroeder wrote this:

> After all is said and done, nothing remains so steadily confirmed as the supreme influence of the human factor, the personnel, the man behind the gun. *More important than the production of the finest weapons is the production of the finest skill and nerve and endurance in using them*; and this can exist only hand in hand with the familiarity born of constant practice by all, from the admiral and the captain to the gun-pointer and mechanic.[118]

Sydney Tyler, recording his war correspondence in 1905, reported that the "marked inferiority" of the Russian shooting was one of the principle causes of the Russian defeat.[119] The notion that the quality of the respective sailors- the gunners in particular- was the decisive factor continues to be perpetuated today. Writing a hundred years later, Ronald Spector concludes his assessment of Tsushima by accrediting the victory to Togo's "well-trained experienced gun crews" who "could fire faster and perform coolly under fire."[120]

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[118] Seaton Schroeder, "Gleanings from the Sea of Japan," (2002) <http://www.russojapanesewar.com/gleanings.html>. Italics added. The Battle of Tsushima Strait is also known as the Battle of the Japan Sea.

[119] Sydney Tyler, *The Japan-Russia War* (Philadelphia, P. W. Ziegler Co., 1905), 553.

[120] Spector, *At War at Sea*, 396.

The sailors and officers aboard the Japanese ships were indeed seasoned veterans. These men had been at sea since the beginning of the war, participating in the blockade of Port Arthur. The Combined Fleet had already been through a major engagement, the Battle of the Yellow Sea (July 28th 1904), which provided the Japanese crewmen with real battle experience.[121] For the most part the sailors aboard the Japanese warships were volunteers, though conscripted men did also serve. In the IJN, conscripts were enlisted for four years of active duty, as opposed to the seven years faced by Russian sailor conscripts.[122] At the beginning of the battle, the Japanese crewmen were in good spirits. Evans & Peattie describe the mood aboard the warships as predominated by a "sense of optimism".[123]

According to Spector, who draws on Westwood extensively, the Second Pacific Squadron was largely composed of conscripts.[124] Pleshakov notes that "some men" in the Squadron had actually been enlisted from the prisons of "Kronshtadt and St. Petersburg".[125] Semenoff is more precise, stating that half of the sailors were "recruits" having little training beyond basic rifle drill.[126] Novikoff-Priboy describes his colleagues as sailors from "shore service" and "reservists."[127] Some of these men it seems had considerable experience, even if they had not recently served. Westwood believes these

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[121] That battle, interestingly, hade been decided when a pair of Japanese *furoshiki* shells hit the Russian flagship, the *Tsarevich*, and killed Admiral Vitgeft who was commanding. In addition to destroying the bridge of the flagship, the steering gear was ruined such that the *Tsarevich* lost control and promptly disorganized the entire fleet.

"Battle of the Yellow Sea," (2002) <http://www.russojapanesewar.com/bttl-yellow-sea.html> (accessed April 12, 2008)

[122] Westwood, *Witnesses of Tsushima*, 28 & 7.

[123] Evans & Peattie, *116*.

[124] Spector, *At War at Sea*, 11.

[125] Pleshakov, *The Tsar's Last Armada,* 59.

[126] Semenoff, *The Reckoning,* 295.

[127] Novikoff-Priboy, *Tsushima*, *10*.

reservists, though aging, "had sea in their blood."[128] The crews of the Russian warships were thus composed of both veterans and new conscripts.

The voyage from Russia had been physically enduring, the crew suffering from tropical heat and constant hardship. Though a demoralizing experience, Rozhestvenskii had managed to prepare the crew a basic manner. Hough describes the voyage at length, and Pleshakov provides the modern reader with an updated account. Semenoff's journal features prominently in both renditions. During the trip the Russian gunners had also spent some time training, and had displayed at least competent accuracy during practice shooting.[129] In the event, Russian gunnery at Tsushima proved capable, the Russians scoring "about forty hits with 12-inch projectiles," this number being quite close to that scored by the Japanese likewise.[130] Furthermore, despite the superiority of Japanese training and experience, the gunners aboard the Japanese warships only managed to hit their targets about 10 percent of the time, far from overwhelming accuracy.[131] Lastly, Rozhestvenskii had taken measures to remove from his fleet the criminals St. Petersburg had saddled him with. "In an effort to clear the fleet of its worst elements (and also to avoid pressure on the overcrowded lockups), Rozhestvensky decided to get rid of the old *Malay* and send her home with the worst offenders, together with a few of the most seriously ill."[132]

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[128] Westwood, *Witnesses of Tsushima*, 7.

[129] "…On the 13th, 18th, and 19th, the whole Squadron went to sea for target practice. The first practice was not very good but the second and third were excellent. It is quite evident how we need practice. The 12-inch batteries fired particularly well, the forward turret, for example, scored 5 out of 6 hits… the Squadron also maneuvered quite well, especially the 1st Battleship Division…" Westwood, *Witnesses of Tsushima*, 129.

[130] Evans & Peattie, *Kaigun*, 125.

[131] Ibid.

[132] Hough, *The fleet that had to die*, 105.

These accounts and figures produce a very different picture then that rendered by some writers immediately after the battle. In Sydney Taylor's account "the marked inferiority of the Russian gunnery" is cited as a crucial reason for the Russian defeat.[133] On August 11th 1906, the New York Sun concluded that "the capital reason" for the Russian defeat was what amounted to a disparity in crew enthusiasm.[134] Presumably this "lukewarm" approach to combat taken by the Russians accounted for their supposedly poor performance in battle. It seems to me that these early accounts of poor Russian gunnery, and generally poor crew 'quality' are actually a product of misunderstanding: The Russian gunnery was only 'markedly inferior' in the sense that the Russian gunners were inflicting less damage per hit then their Japanese counterparts.

Two factors contributed to the gunnery disparity: the experience of the crew and the capabilities of the weapons and ammunition being fired. It is true, the Japanese had more immediate battle experience, and if one were to qualitatively assess the respective crews, the Japanese would dominate. But what about the quality of the weapons and munitions?

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[133] Taylor, *The Japan-Russia War*, 554.

[134] New York Sun, *Why The Russians Lost in the Recent War*, (August 11, 1906) <http://www.russojapanesewar.com/nysun.html> (accessed April 12, 2008).

Weapons & Ammunition.

With regard to weaponry, the principle armament aboard every warship in the ironclad age were the guns it carried. The gun had developed along a long historical trajectory.[135] The invention of a projectile weapon utilizing a chemical propellant dates back to the medieval period in Europe. Let it suffice to say that the wooden sailing warship was "above all else, a floating gun battery" whose entire function and purpose rested in bringing to battle as many heavy cannon as possible.[136] This basic principle did not change during the ironclad era, though the gun itself was wholly transformed by the scientific and industrial revolutions of the 19th century. This does not mean that progress was rapid, indeed as late as 1860 the naval gun remained essentially the same weapon which had been employed "three centuries earlier."[137] By the 1880s, however, a series of innovations were adopted which kept the gun competitive with improvements in armour protection. These innovations were the dissemination of rifled barrels, slow-burning powder, the breach-loading technique, and the adoption of the quick firing principle.[138]

Gun rifling refers to a feature of the gun barrel; the 'rifles' being a series of orbiting grooves raised along the interior length of the barrel. These spiraling grooves produce a spinning effect upon on any projectile fired from the gun. Spinning projectiles suffer less air resistance, with the result of an increase in both and accuracy. The rifling technique had been known and utilized since the sixteenth century, however the concept did not become widely practical until slow-burning powder was introduced in the

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[135] See Appendix (H) for a comparison between the ranges of various naval guns since the 16th century.

[136] Robert Gardiner & Brian Lavery, "Guns and Gunnery," in *The Line of Battle: The Sailing Warship 1650-1840* (London: Conway Maritime Press, 2004), 146.

[137] Brodie, *Sea Power in the Machine Age*, 181.

[138] Ibid., 198.

1880s.[139] Slow-burning powder, developed in its modern form by the American, Rodman, was designed to provide "steadily increasing thrust" as a projectile traveled down the length of the gun barrel, rather than the "sharp jab" caused by regular explosive propellant.[140] The use of slow-burning powder meant that as the projectile reached the end length of the barrel, it would be traveling at its fastest speed.[141] Guns capable of hurling spinning high velocity shells were markedly more accurate and powerful then their predecessors.

The second major innovation was the breech loading principle. Weapons loaded from the breech- that is, from the rear- had been devised as early as the medieval period but were largely abandoned during the following centuries as the smooth-bore muzzle-loader became ubiquitous. Slow-burning powder ultimately served to elevate the breech-loader to prominence at the end of the 19th century. As we have seen, slow-burning powder drastically increased the velocity at which a projectile could be fired. To further increase a shell's velocity, the gun barrel could be lengthened. Longer barrels forced greater pressure upon their projectiles for longer durations. Long barrels are more difficult to reload from the muzzle than short barrels and so the breech-loading mechanism became the obvious solution.[142] At the time of Tsushima, the muzzle-loader (with a few notable exceptions) had all but disappeared from naval warfare. Every modern warship was outfitted with breech-loading guns featuring long tapered barrels and rifling grooves.

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[139] Ibid., 185 & 192.
[140] Padfield, *Battleship Era*, 104.
[141] Brodie, *Sea Power in the Machine Age*, 221.
[142] Padfield, *Battleship Era*, 104.

The quick-firing gun, the last of the 19th century innovations in naval armament, served to radically increase the vulnerability of unarmoured warships while simultaneously undermining the challenge posed to the gun's prominence by torpedo boats.[143] The principle behind the QF guns was taken from the "various multi-barrel machine guns" which had preceded it. These weapons had been adopted by navies across the globe to fend off small boats armed with primitive torpedoes.[144] As the torpedo became a more sophisticated weapon, and as torpedo boats became faster and more maneuverable, heavier guns were required. What really made these guns work was the cartridge system: the projectile and the powder charge were designed as a single component, reducing reload times.[145] Initially QF guns were produced in the 4.7 inch format, but 6 inch and 8 inch versions were soon adopted.[146]

How did the armaments of the Combined Fleet and the Second Pacific Squadron compare quantitatively? The Second Pacific Squadron could employ some "26 12-inch guns (only 16 of them modern weapons mounted in ships of modern construction), 17 10-inch guns and 121 8-inch to 6-inch on one broadside" against the Combined Fleet.[147] The Combined Fleet was capable of responding with "16 12-inch guns (on [Togo's] four battleships) and 112 8-inch and 6-inch able to fire on any one broadside."[148] The Russians seemed to posses a large numeric advantage in 12-inch guns. However, the two fleets were almost equal in terms of secondary batteries.[149] Additionally, while the

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[143] Brodie, *Sea Power in the Machine Age*, 225.
[144] Padfield, *The Battleship Era*, 105.
[145] Ibid., 105-6.
[146] Ibid., 106. Evans & Peattie, *Kaigun*, 62.
[147] Padfield, *The Battleship Era,* 175.
[148] Ibid.
[149] Ibid.

Second Squadron was steaming its towards Vladivostok, the Combined Fleet was having its gun barrels refitted.[150] The Second Pacific Squadron could not afford this luxury. In fact, in an effort to preserve the barrels of his ships from wear, and maintain an adequate supply of ammunition, Rohzestvenskii had conducted only a few days of practice firing.[151]

For the most part, the Russian guns were longer than their Japanese equivalents. The added length of the Russian gun barrels was in keeping with Russian gunnery doctrine which favored armour penetration. Longer barrels generally produced higher projectile velocity, and thus, a greater likelihood of penetrating armour plate. Barrel length was measured in 'calibers' meaning the "length of the barrel described in multiples of the diameter of the bore".[152] Bore diameter is referred to in the singular, caliber. Thus the 6/40 Elswick QF guns aboard the Japanese battleships and cruisers possessed a bore caliber of 6 inches, and a length of 40 calibers, or 240 inches (a little over 6 meters).[153] Shells fired from these guns left the gun muzzle traveling at 701 meters per second.[154] Whereas, shells fired from the 6/45 Canet QF guns aboard Russian warships possessed a muzzle velocity of 792 meters per second.[155] These weapons were about 6.8 meters long, as the designation indicates, roughly 5 calibers longer than the Japanese equivalent.

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[150] Westwood, *Witnesses of Tsushima*, 137.

[151] As mentioned above, however, when he did conduct practice his gunners demonstrated a fair degree of accuracy.

[152] Tony DiGuilian, "Definitions and Information about Naval Guns – Part 1," (January 23, 2008) <http://www.navweaps.com/Weapons/Gun_Data.htm> (accessed April 3, 2008).

[153] Naval Weapons, "Japanese 6"/40 (15.2 cm) EOC Patterns," (January 7, 2007) <http://www.navweaps.com/Weapons/WNJAP_6-40_EOC.htm> (accessed April 3, 2008)

[154] Kent Crawford, "Naval Ordnance Japan," (2002) <http://www.russojapanesewar.com/jpn-gun.html> (accessed April 3, 2008).

[155] Kent Crawford, "Naval Ordnance Russia," (2002) <http://www.russojapanesewar.com/russ-gun.html> (accessed April 3, 2008).

The Russian advantage in bore length was specific to QF guns. The 12-inch main guns aboard the *Borodinos* and the Japanese battleships were both of 40 calibers length (a little over 12 meters).[156] That said, the Russian guns still managed higher muzzle velocities, in keeping with their fixation on armour penetrating weaponry. The difference is not huge, but it is present nevertheless. The 12/40 main guns aboard the *Borodino* class, for example, could hurl a shell at almost 800 meters per second, while the Elswick 12/40s aboard the Japanese battleships could manage about 730 meters per second.[157] In regard to muzzle velocity then, it can be seen that the Russians possessed a slight advantage in both QF and heavy guns, as their tactical doctrine would dictate. Westwood covers much of this ground in his excellent chapter on "Russian Naval Policy".[158]

With regards to armour penetration, the 12-inch Obuchoff guns of the Canet design employed by the Russians, if firing capped AP shells as they did at Tsushima, could penetrate at least 15-and-a-half inches of solid Krupp-Cemented armour at 3000 yards.[159] These weapons, in effect, could defeat the armour of any warship in the Combined Fleet, if the range was close enough. That said, the 12-inch Elswick guns aboard the Japanese warships could penetrate at least as much KC armour as the Russian equivalent, if AP capped shells were fired.[160] Fitted with their instant fusing and thin skin, however, the *furoshiki* shells fired by the Japanese were unlikely to penetrate any armour at all.

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[156] Ibid.

[157] Crawford, "Naval Ordnance Russia," (2002) <http://www.russojapanesewar.com/russ-gun.html> (accessed April 3, 2008) & Crawford, "Naval Ordnance Japan," (2002) <http://www.russojapanesewar.com/jpn-gun.html> (accessed April 3, 2008).

[158] Westwood, "Intro. 1: Russian Naval Policy," in *Witnesses of Tsushima*, 23.

[159] Fred T. Jane, "Russian ARMAMENT AND EQUIPMENT," (1904) <http://www.russojapanesewar.com/russian-hdw.html> (accessed April 6, 2008).

[160] Ibid.

With regards to ammunition, I believe that the *furoshiki* shells proved decisively advantageous during the battle. The Russians possessed no protection against these shells, nor were their own shells nearly as devastatingly effective. I will also discuss the effectiveness of Japanese torpedoes which unlike their Russian counterparts, saw significant employment during the battle.

The shell, a canister containing an explosive charge, began its naval career in the form of the 'bomb' lobbed from mortars aboard wooden sailing ships.[161] In principle the shell was a "hollow iron cylinder" made explosive by its fuse and gunpowder filling.[162] Suffering from their defeats in the Napoleonic Wars, the French pursued a series of innovations with the intention of equalizing the naval disparity England enjoyed over its continental rival. Based on the ideas of Colonel Paixhans, a French artillery officer, the shell-gun was introduced in 1824.[163] This weapon could deliver its shells along a horizontal trajectory, and with devastating effect against flammable wooden hulls. It was immediately recognized that armouring with iron would be necessary to protect the wooden hull from these bursting shells. However, thirty years would pass before the metallurgy industry in Europe could produce armour plates capable of withstanding large caliber shells. So began the technological race between shells and armouring which indeed continues inconclusively to this day.

The Japanese and Russians adhered to different doctrines with regards to the design and employment of their shells. The Russians, following the course pursued by the French navy, maintained that the shell was first and foremost a penetrating weapon.

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[161] Gardiner & Lavery, "Guns and Gunnery," in *The Line of Battle: The Sailing Warship 1650-1840,* 154.

[162] Ibid., 158.

[163] Padfield, *The Battleship Era*, 14.

According to the Imperial Russian Navy the shell's purpose was to defeat the armour of an opponent's ship, delivering its explosive payload to the vital areas, causing catastrophic damage. In a battle, the outcome would be decided by a few decisive, critical hits. Thus, the Russian navy focused their design philosophy on armour penetrating (AP) shells.[164] The Japanese, on the other hand, favored high-explosive shells: unlikely to penetrate modern battleship armour, but quite capable of reducing 'soft' targets, specifically the life-blood of the warship, the crew.

In the previous chapter I suggested that the Japanese did not win solely because of their superior crew 'quality' nor did the Russians lose for reasons of crew inferiority. The Japanese were victorious because their gunfire systematically decimated the Russian ships. Under the Japanese barrage the Russian crews were either killed or incapacitated such that their ability to retaliate was rapidly reduced. The chapter above on ship designs indicated that the early 20th century warship was a large and complex system. The human crew could be described as a component of that system, albeit a biological one. Long before beginning the war with Russia, the Japanese had realized, strongly influenced by thinkers in the Royal Navy, that the human crew represented the weakest and most vulnerable part of the 'ironclad system'. Crews were unarmoured, and if killed or badly wounded the experience they possessed could not be easily replaced. The human sailor, more-over, was generally costly to train, feed and house.

The naval thinkers in Japan believed that even the most disciplined and committed crew could be overwhelmed by gunfire. Furthermore it was believed, in light of the protective capabilities of early 20th century armour plate, that incapacitating the

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[164] AP ammunition had been first developed by Joseph Whitworth in the 1860s. Brodie, *Sea Power in the Machine Age*, 197.

crew of an enemy warship would be easier than actually sinking it.[165] Certainly this had been proven to be the case during the Sino-Japanese War, at the Battle of the Yalu (September 17th, 1894).[166] The Yalu, the decisive engagement of that war, was determined by Japanese quick-firing guns. In their 6-inch format, these weapons could fire ten 100 pound shells in fifty seconds.[167] To the crews manning the decks of the Qing dynasty's Peiyang Fleet, the hail of fire produced by these weapons was horrendous. Once crippled by shellfire a warship could be sunk by any number of means, from firing at it armour piercing munitions, or torpedoes, to laying mines across its path, or even by ramming it- though this last method had not been attempted in war since the *Huascar*/*Esmeralda* engagement between Peru and Chilie in 1879.[168]

Towards this end, the Japanese made several modifications to standard 'common' armour piercing ammunition. Consider, for example, the 12-inch shells fired from the Elswick/Armstrong 12/40 Pattern G guns fitted aboard the *Mikasa*. Two types of munitions were fired from these weapons at Tsushima: Common Pointed, that is, high-explosive, and Armour Piercing.[169] These 385 kilogram shells were fitted, respectively, with 39 and 19 kilogram bursting charges. That is, nearly 10% of the total mass of a

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[165] Evans & Peattie, *Kaigun*, 63.

[166] Brodie, *Sea Power in the Machine Age*, 256. That 1894 war had been a crucial event for the development of the Imperial Japanese Navy. The fact that an Imperial Japan had defeated the Qing dynasty was itself a remarkable political and military event, but it was even more astounding that the Japanese had achieved this victory with a navy almost entirely purchased from abroad.

[167] Evans & Peattie, *Kaigun*, 54.

[168] Every major capital ship present at Tsushima was fitted with a ram. These rams were "huge beaks on the prow below the water-line—great cumbersome projections which affected the sailing qualities of the ship." Admiral Makarov, generally accredited as the most competent of the Russian admirals during the Russo-Japanese War, had in 1897 written an extensive section of his *Naval Tactics* on the uses of the ram. The ram was not utilized at Tsushima, though the weapon would receive a brief resurgence during the First World War for its use at sinking submarines. Padfield, *The Battleship Era.* 86. & Brodie, *Sea Power in the Machine Age*, 87.

[169] Crawford, "Naval Ordnance Japan," (2002) <http://www.russojapanesewar.com/jpn-gun.html> (accessed February 20, 2008).

Common Pointed shell, and 5% for Armour Piercing shells, was devoted to bursting charge.[170] Comparing these figures to the Russian equivalent demonstrates the marked differences: The 12/40 1895 guns mounted on the *Suvarov*, fired 331 kilogram shells of the Common Pointed and Armour Piercing Capped type, dedicating 12.4 kilograms (3.7%) and 5.3 kilograms (1.6%) to respective bursting charges.[171]

Besides the Russian utilization of 'capped' shells (more on that below), one will notice the relatively small mass dedicated to bursting charge in the Russian 12-inch shells. Small bursting charge allowed for greater thickness of the shell's skin, improving the shell's penetrating capabilities. To achieve larger bursting charges, the Japanese intentionally sacrificed penetrating power. Skin thickness was reduced to the point that the Japanese shells lost integrity upon impact and shattered. Due to this design, "there is no recorded case" of a successful armour penetration by a Japanese shell at Tsushima.[172] The thin-skinned shells, after all, were not designed to defeat armour at all. It was this 'thin skin' which gave these munitions their name; *furoshiki*, "after the thin Japanese kerchief."[173] A special fuse, known as the Ijuin fuse (named so after Admiral Ijuin Goro who led the team which developed it) was fitted to these *furoshiki* shells.[174] The Ijuin fuse was essentially an impact detonator, designed to explode the shell at the slightest provocation. The Ijuin fuses served to render even missed shots lethal, due to the splinter

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[170] Naval Weapons, "Japanese 12"/40 (30.5 cm) EOC," (27 October 2007) <http://www.navweaps.com/Weapons/WNJAP_12-40_EOC.htm> (accessed February 20, 2008).

[171] Naval Weapons, "Russian 12"/40 (30.5 cm) Pattern 1895," (December 5, 2006) <http://www.navweaps.com/Weapons/WNRussian_12-40_m1895.htm> (accessed February 20, 2008), & Crawford, "Naval Ordnance Russia," (2002) <http://www.russojapanesewar.com/russ-gun.html> (accessed February 20, 2008).

[172] Evans & Peattie, *Kaigun*, 125.

[173] Pleshakov, *The Tsar's Last Armada*, 270.

[174] Ibid, 270.

fragments the burst shells would hurl in all directions. Indeed, at Tsushima the *furoshiki* shells would explode "as soon as they touched the water."[175]

The crowning achievement of Japanese shell design was the bursting charge itself: the Shimose explosive.[176] Named after its inventor, Shimose Masakazu, this powerful explosive was loaded into a variety of shells throughout magazines of the fleet, and by virtue of its popularity was widely employed at Tsushima. According to Evans & Peattie, the Shimose formula was derived from the French picric acid explosive, Melinite.[177] It seems a "sample of Melinite… was brought back from France under questionable circumstances" and then developed by Shimose in Japan.[178] Noel Busch relates the "questionable circumstances" by which the Japanese acquired the Melanite sample:

> …its acquisition actually dated back to the summer of 1888, when a clever young Japanese naval officer named Sadayasu Tomioka had been sent to France to witness a demonstration of a new kind of powder developed there by a professional inventor who had indicated willingness to sell his formula to the Japanese. Unfortunately for the success of this plan he… had made the mistake of underestimating the sophistication of his visitor. While examining the novel powder, Tomioka contrived to get a few grains of it under one of his fingernails. Placed under a microscope a little later, these sufficed to show that the secret ingredient in it was nothing more than picric acid, a chemical well-known in Japan and readily procurable from local sources.[179]

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[175] Busch, *The Emperor's Sword*, 155.

[176] With the reservation that this novel invention should not receive *all* the credit. The Japanese (and Russians) extensively utilized shells filled with black powder explosive (classic gunpowder), which was itself a fine incendiary, and a well tested shell filler. However, the Russians possessed nothing comparable to the Shimose with regards to blast pressure or heat generation. Keith Allen, *Russo-Japanese War Ramblings*, (1999) <http://www.gwpda.org/naval/rjwargun.htm> (accessed April 13, 2008).

[177] Evans & Peattie, *Kaigun*, 63.

[178] Ibid., 549.

[179] Busch, *The Emperor's Sword*, 117.

The formula Shimose developed exploded faster and produced greater heat and pressure than the Russian explosives were capable of .[180] The Shimose would be remembered at Tsushima for its incendiary effects, and for the noxious fumes it produced.[181] Indeed, Japanese shells fitted with Shimose were seen to set the paint of the Russian ships alight, causing a terrifying phenomena: "what looked like 'liquid flame' [was seen] leaping on the sides of the ship as if the steel itself was on fire."[182] Writing of this after the battle, Rozhestvenskii recalled the effects of the Shimose explosive: "Everything began to burn and even in the conning tower I was literally enveloped in flames."[183] Reports of this nature are common.[184] Togo himself recalled the "strong conflagration" which enveloped the Russian ships as the Combined Fleet intensified its firing.[185] One by one the Russian battleships lost control and "burst heavily into flame" according to his report.[186] Novikoff-Priboy relates how the fires started by the shelling scoured the interior sections of the Russian warships, threatening the lives of the crew at their stations.[187]

In addition to yielding a greater explosive charge and producing incendiary effects, the Shimose formula was prized for the incapacitating nature of its smoke. A Russian doctor, present at the battle, described the effects of this Shimose gas:

> On breathing these gases there occurred a phenomenon similar to a fierce attack of coughing, as in severe bronchitis, and accompanied by a flushing of the face. This sensation lasted quite a long time and many said that afterward they experienced a severe headache and thirst.[188]

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[180] Ibid.

[181] Ibid, 120.

[182] Pleshakov, *The Tsar's Last Armada*, 271.

[183] Hough, *The fleet that had to die*, 204.

[184] Taylor, *The Japan-Russia War*, 545.

[185] Togo Heihachiro, *Admiral Togo's Report of the Battle of Tsushima* <http://www.russojapanesewar.com/togo-aar3.html> (accessed 2 April 2008).

[186] Ibid.

[187] Novikoff-Priboy, *Tsushima,* 217.

[188] Westwood, *Witnesses of Tsushima* (Tokyo: Sophia University, 1970), 228.

These effects were compounded by the coal dust which had accumulated aboard the Russian squadron during the voyage. Where before this black dust had settled about the ships, now amidst the explosion of shells it was swept up and inhaled by the crew.[189]

The Shimose explosive was not without its faults. When first employed in battle the explosive had proven rather unstable due to the "extra sensitivity" of the Shimose explosive.[190] Indeed, *furoshiki* shells fired early in war had the nasty tendency to explode in their gun barrels. Padfield believes these premature detonations were caused by a fault in the Ijuin fuse.[191] By May of 1905 the faults in the *furoshiki* shells had been corrected, providing the Japanese with a decisive technological advantage.

The Russian navy pursued a completely different direction with regards to shell design. Russian shells were armour piercing, built with thick-skins and fitted with delayed fuses. When they did not fail to explode- and are there are many examples of faulty Russian shells- the Russian AP shells served their purpose admirably.[192] For example, Westwood reports that the heavy side armour of the *Mikasa* was twice penetrated by Russian shells.[193] We have already read of the damage these shells inflicted upon the Combined Fleet in the first few minutes of the battle. Though essential for armour penetration, the delayed fusing demonstrated a clear disadvantage: misses would plunge under water before exploding, and thus would produce "little smoke."[194] This was critical, for it meant that the Japanese were able to sight their guns and fire without shell

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[189] Novikoff-Priboy, *Tsushima*, 168.
[190] Busch, *The Emperor's Sword*, 117.
[191] Padfield, *The Battleship Era*, 181.
[192] Semenoff, *The Reckoning*, 197.
[193] Westwood, *Witnesses of Tsushima*, 192.
[194] Busch, *The Emperor's Sword*, 154-5.

smoke obstructing their vision. The Russian gunners, on the other hand, quickly found themselves surrounded by Shimose fumes.[195]

In terms of explosives, the Russians primarily utilized wet guncotton; a nitrocellulose based explosive widely employed at the turn of the century as a burster and a primer. Guncotton is well known in this latter form as so called 'smokeless' gunpowder. The production of smokeless charges was a long project in experimentation, which in Britain resulted in the production of 'Cordite'. Cordite combined both nitrocellulose and nitroglycerin into the form of a propellant rolled into cords ("hence the name").[196] Similar to Cordite, wet guncotton, was to prove markedly inferior to the Shimose explosive at Tsushima. Due to the "insensitive" nature of the guncotton explosive, Russian shells routinely failed to detonate.[197] According to Westwood, "of the twenty-four 12-inch and thirty-six 6-inch hits scored by the Russians, eight and sixteen were with shells which failed to explode."[198] Though the Russians also utilized the less powerful, but more reliable black powder explosive, only their older uncapped and fragile iron-skinned shells were so fitted.[199] Iron-skinned shells tended to shatter when fired, and there are many reports of disintegrated iron fragments hitting the Combined Fleet to little effect.

With regards to shell capping, the Russians were world leaders.[200] Essentially 'capping' a shell involved covering the tip of the shell in a soft metal, which, upon

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[195] Ibid.

[196] Padfield, *The Battleship Era*, 148.

[197] Allen, *Russo-Japanese War Ramblings*, (1999) <http://www.gwpda.org/naval/rjwargun.htm> (accessed April 13, 2008).

[198] Westwood, *Witnesses of Tsushima*, 227.

[199] Semenoff, *The Reckoning*, 197-8.

[200] Padfield, *The Battleship Era*, 149.

impact, "pre-stressed" the armour.[201] So weakened, the main mass of the hardened AP shell would then have an easier time piercing the armour plate. So long as the shell impacted at or near a right angle, capped shells were "15 per cent" more likely to penetrate then uncapped shells.[202] No doubt capping went far to improve the ability of Russian AP shells to defeat Japanese armour.

In sum, the Japanese *furoshiki* shells were devastatingly effective against crewmen, though they were also quite useless against armour plate. Russian gunnery doctrine called for a different policy; AP shells to "destroy heavy ships" precisely by defeating thick armour.[203] This distinction, more than any other factor, produced the Japanese victory.[204]

Another point which must be compared is the rate of fire produced by the respective fleets. Though ultimately the *furoshiki* shells produced the most devastating effects against the Russian fleet, the fact that the Japanese were able to fire faster than the Russians was also important. Two factors influenced rate of fire- the skill of the gunners, for one, and the design of the individual guns' reloading mechanisms. Speaking generally, Russian gunners reloaded at a slower rate than their Japanese equivalents. The reasons for this are not purely the fault of the gunners, however. In actuality, reloading technology played a greater role than the skill of the gunners. Both sides utilized the latest technology for reloading. The 12-inch guns on the *Mikasa*, for example, were reloaded via an electric system, and each gun could fire "three shells every two

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[201] Ibid.
[202] Ibid.
[203] Evans & Peattie, *Kaigun*, 125.
[204] Ibid.

minutes."[205] However, the guns could also be loaded by hydraulics or even manually in the event of power loss.[206] Russian heavy guns were likewise possessing of a "high degree of mechanization" to reduce the crew compliment required to reload the guns.[207] Westwood believes that this high degree of mechanization in the Russian weapons systems was in part to fault for the slower Russian rate of fire. The Russian guns could be serviced by fewer crewmen, but this meant that it took the gunners longer to physically handle ammunition into place.[208] The layout and design of the turrets also impacted the rate at which the largest guns could be reloaded. It seems the Japanese possessed a degree of advantage in this regard due to the unique design of their 'barbette' turrets. The Japanese followed the British system for protecting their main-guns, by "enclosing" the guns with a sloped armour shield.[209] This system, known as the 'barbette' turret allowed provided more operational room and made for faster reloading and significantly heralded the future of turret design. The Russians, on the other hand, maintained the use of inefficient but uniformly protected "cylindrical" turrets.[210]

In practice the factors influencing rate of fire varied rapidly and unpredictably between individual guns and crews such that there is little point to calculating the actual rates of fire. Let is suffice to say that the Japanese weapons, as a whole, fired and reloaded at a rate greater than that of the Russian ships. Novikoff-Priboy claims the Japanese fired twice as fast, "to judge by the flashes" coming from the Combined

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[205] Ibid., 61. See Appendix (I) for a schematic of the 12-inch guns onboard the *Mikasa*.
[206] Gardiner, et all, *Conway's All The World's Fighting Ships: 1860-1905*, 182.
[207] Westwood, *Witnesses of Tsushima*, 23.
[208] Ibid.
[209] Padfield, *The Battleship Era*. 148.
[210] Ibid.

Fleet.[211] This advantage was in part due to the experience of the Japanese gunners, it is true, and in part due to the nature of Japanese gun and turret design. Of course, the high rate of the Japanese fire was perfectly fitting with their gunnery doctrine which focused on volume of fire, since there was little chance of the Japanese shells actually penetrating the armour of the Russian.

Centralized fire control also played a role in differentiating the rate and accuracy of gunfire. Fire control was a new method of gunnery practice, just coming into use at this period, having been pioneered by the Royal Navy. Fire control treated the weapons of a warship uniformly, with the objective of greatly increasing the percentage of shots to hits. In practice, fire control boiled down to two components: the centralization of gun command under a single officer who could direct the shooting of the entire ship, and the adoption of devices capable of calculating the "range, bearing, course and speed" of the targeted ships so that accurate fire could be maintained.[212] The Barr & Stroud rangefinders provided the warships at Tsushima with this information. The Russian ships were outfitted with Barr & Stroud devices before they left Russia and thus range-finding equipment represented one of the newest technologies adopted by the Second Pacific Squadron.[213] The Japanese ships had been fitted with Barr & Stroud range finders since the beginning of the war.[214]

The system for 'spotting' hits at Tsushima involved an officer aboard each warship who watched the falling shells and reported hits. However, as each gunner for

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[211] Novikoff-Priboy, *Tsushima*, 165.

[212] Padfield, *Battleship Era*, 183.

[213] David K. Brown, "The Russo-Japanese War: Technical Lessons as Perceived by the Royal Navy," in, *Warship 1993*, eds., David McLean & Antony Preston (London: Conway Maritime Press, 1996), 67-8.

[214] Keith, *Russo-Japanese War Ramblings* (1999) <http://www.gwpda.org/naval/rjwargun.htm> (accessed April 13, 2008).

each battery was essentially responsible only for his immediate weapon, the range finding/hit spotting system "broke down" whenever gunfire became intense.[215] The reason for the failure of this system was essentially due to the complicated nature of transmitting range and hit information between the gunners, range finders, and the spotting officer. Once the range finder had acquired the information needed to calibrate accurate fire, the officer in charge would transmit this information to the bridge of the ship via voicepipe where it would then be internally telegraphed to the gunners. Basically the voicepipes did not function very well when the gunfire became intense as the sound of the human voice was easily washed out by the drone of gunfire.[216] Novikoff-Priboy describes the confusion inherent in this procedure.

> An order was transmitted to the central post, and thence to the port turrets… In one of the turrets there was a misunderstanding. The recipient of the order could not understand it, and thought there must be something wrong… The order had to be repeated several times…[217]

Additionally, this system was quite reliant on electric power without which the information could not be telegraphed to the gunners, and thus a power failure would deprive the entire system of operation. Furthermore, it seems that the rangefinders utilized by both sides were "faulty" or "badly calibrated and served by men not properly trained in their use."[218] That said it seems that the Barr & Stroud range finders aboard the Japanese ships "worked perfectly" during the siege of Port Arthur.[219] Of course, the contextual difference between the Port Arthur blockade and the Battle of Tsushima could not be greater; the former lacking all of the psychological and organizational strain of the

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[215] Padfield, *Battleship Era*. 183.

[216] Ibid., 101.

[217] Novikoff-Priboy, *Tsushima*, 164.

[218] Westwood, *Witnesses of Tsushima*, 227.

[219] Jane, "Japanese ARMAMENT AND EQUIPMENT," (1904) <http://www.russojapanesewar.com/japanese-hdw.html> (accessed April 6 2008).

latter. Thus, though the Barr & Stroud device was to be found throughout both fleets, its presence did not make a profound impact on the outcome of the battle. Even had these early fire-control systems operated successfully, gun barrel wear during battle prevented sustained accurate firing. As the battle progressed, repeated firings served to wear out the rifling inside the gun barrels making accuracy even more difficult to achieve. As Padfield concludes, the gunfire at Tsushima was so "unscientific and wasteful" that it seems certain that range-finding and fire control played only the smallest role in the outcome.[220]

Though the Japanese succeeded in sinking several Russian ships from gunfire alone, Japanese tactical doctrine actually favored torpedoes for this role. The torpedo was thus a crucial component of the overall Japanese strategy for destroying the Second Pacific Squadron- though in the event the torpedo proved at best only partially successful.

The torpedo's origins can be traced to several sources, perhaps the earliest influence being the fireship. The principle behind the fireship was to cause devastating damage at extremely close range. Fireships were initially merchant vessels packed with flammable material and carrying fireworks as fuses.[221] After maneuvering into close quarters, the skeleton crew would set the fireworks burning and then abandon the ship. If their target remained stationary and everything went favorably, the fireship would become entangled against its target causing much havoc and scattering flame upon the enemy's decks.

The advent of armouring during the industrial revolution produced the need for a weapon capable of striking against the unarmoured portions of warships, which generally meant the submerged portions of the ship. The explosive charges conceived to fulfill this

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[220] Padfield, *Battleship Era*. 181.

[221] Gardiner & Brian, *The Line of Battle: The Sailing Warship 1650-1840*, 85.

role were known as 'torpedoes'.[222] Initially, the categorization 'torpedo' included both mobile and immobile explosive warheads. These immobile explosives were used "to defend harbours and river mouths" and eventually became known as mines.[223] Mobile torpedoes were initially of the 'spar' type. Essentially these were explosive charges mounted afore small steam boats operated with the goal of exacting direct contact with the exposed and submerged hull of an enemy warship. The infamous Confederate *Hundley*, the first submarine to successfully sink an enemy warship, had accomplished its historic task with a spar torpedo.

The self-propelled torpedo, the weapon with which we are concerned, was first developed in Austria, by Whitehead, an Englishmen, and Lupis, an Austrian naval commander.[224] These early self-propelled torpedoes were lacking in almost every category of performance, being slow, inaccurate, and of short range. Improvement, however, was rapid.[225] By 1885, the Whitehead torpedo, as it became known, had become a staple armament in every major navy.[226] Carrying hundreds of pounds of explosive and capable of 30 knots at speed, the Whitehead torpedo was a greatly feared weapon. The Russian navy had done "more than any nation" to adopt the torpedo into general use.[227] The Japanese, for their part, began producing Whiteheads indigenously in 1897.[228] Two models were built for use aboard ships, the 14 and 18 inch models. The

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[222] The name was derived from a family of electric ray, the Torpedinidae- consider www.fishbase.org for further information (search for 'torpedo').

[223] Padfield, *The Battleship Era*, 55.

[224] Brodie, *Sea Power in the Machine Age*, 276.

[225] Ibid.

[226] Ibid.

[227] Jane, "Japanese ARMAMENT AND EQUIPMENT," (1904) <http://www.russojapanesewar.com/japanese-hdw.html> (accessed 2 April 2008).

[228] Evans & Peattie, *Kaigun*, 55 & 38.

former was specified for use aboard torpedo boats, the latter for use aboard destroyers and capital ships.[229]

The Japanese Fourth Destroyer Flotilla, as we have already seen, managed to torpedo several warships during the battle. By and large, however, these were notable exceptions to what had generally been a very poor showing throughout the war. Ultimately torpedoes managed only to cripple the *Sisoi Veliky*, *Admiral Nakhimov*, and the *Vladimir Monomakh*, all of which were badly damaged a the time.[230] Indeed, against moving targets, successful hits were even rarer: "only 2 percent" of the torpedoes fired against moving ships had found their mark.[231] To successfully deploy a Whitehead torpedo, the attacking craft had to close to less than 500 meters before unleashing their torpedoes. At this short range the torpedo craft were extremely vulnerable to Russian gunfire.[232] Sydney Tyler, in his early assessment of the effectiveness of torpedoes at Tsushima, believed that the cause of "the victory will ultimately be traced" to the role played by torpedoes and torpedo boats.[233] The torpedo was of use to the Japanese at Tsushima, but by no means was the battle decided by that weapon.

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[229] Jane, "Japanese ARMAMENT AND EQUIPMENT," (1904) <http://www.russojapanesewar.com/japanese-hdw.html> (accessed 2 April 2008).

[230] Westwood, *Witnesses of Tsushima*, 232.

[231] Ibid., 128.

[232] Ibid., 234.

[233] Tyler, *The Japan-Russia War*, 553.

Armour.

Iron is the most abundant element on the planet Earth. As with the gun, the use of iron for armour protection dates into antiquity. Indeed the idea of covering a person or a ship hull with protective metal is equally ancient. During the Ironclad age, iron served dual purposes. It was the principle material for ship construction and in the form of the armour plate, the only known mechanism for protecting a warship from enemy shellfire. The end of the Crimean War heralded the beginning of widespread ship armouring. Pioneers had however conducted experiments with iron armouring and construction well before 1855. The first iron warships of the Royal Navy, for example, were designed by John Laird and built for the British East India Company in 1839.[234] The two ships Laird built were paddle steamers, the *Nemesis* and *Phlegethon*, and both took part in the Opium War of 1839-42.[235] Laird followed these success with a series of designs for the Royal Navy, which were hesitantly adopted by the Admiralty. Nevertheless, the use of iron was at this time premature. The metallurgy industry, though it had undergone a rapid series of advances between the beginning and middle of the 19th century, remained in its infancy. Experiments conducted in 1846 against the iron ship *Ruby* confirmed suspicions that iron construction was inadequate: shots fired at the *Ruby* "passed through the vessel" with ease, hurling lethal iron splinters and blasting gaping holes in the ship's hull.[236] Iron's proponents contended that the *Ruby* was hardly a proper warship upon which to conduct

[234] Brodie, *Sea Power in the Machine Age*, 134.
[235] Ibid.
[236] Ibid., 136.

such crucial tests.[237] Furthermore, the continued development of the shell gun and shell ordinance indicated that wood construction was rapidly on the way out.

Strong resilient iron was required to counter the development of the shell, but progress on such capable iron plating was slow. The first battle involving iron hulls was a shelling operation conducted on 17 October 1855 during the Crimean campaign. Three French designed floating batteries, the *Devastation*, *Lave* and *Tonnante*, built of wood but protected by "4 inches of iron" withstood Russian cannon fire for over three hours, and remained in action despite suffering over a hundred hits from both "shot and shell".[238] This event conclusively marked the end of purely wooden ship construction, and convinced the French, in 1858, to begin construction of the 5,630 ton *Gloire*, the first modern armoured seagoing warship: the first true ironclad.[239] The British response, the 9,137 ton *Warrior*, markedly larger then the *Gloire*, became the most powerful warship afloat when launched in 1860. The *Warrior* was in many respects more revolutionary than the *Dreadnaught*, for while the latter could still, in theory, be overwhelmed by the guns of older ships, the *Warrior*'s armour could defeat the weapons of every warship built before it. The Royal Navy stopped building first rate wooden warships in 1865. France followed in 1869, both powers turning exclusively to iron construction for their capital ships.[240] This innovation and response dichotomy served to launch a naval race between Britain and France which continued throughout the ironclad era.

In 1905 the best armour available for warship protection was the Krupp-Cemented (KC) armour. KC armour was a compound produced by "adding chromium

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[237] Ibid.

[238] Padfield, *The Battleship Era*, 16.

[239] Tony Gibbons, "*Gloire*" in *The Encyclopedia of Ships* (San Diego: Thunder Bay Press, 2001), 252.

[240] Brodie, *Sea Power in the Machine Age*, 147.

and manganese" to nickel-steel plate.[241] An elaborate manufacturing process hardened the KC plates to the effect that they provided protection "two and a half times better than iron."[242] The second best armour was Harvey Nickel-Steel plate developed in 1890.[243] H. A. Harvey, an American, had developed his armour by increasing the carbon component of French developed Schneider Nickel-Steel "from 0.2 percent to over 1 per cent".[244] Harvey's improved NS armour was twice as strong as wrought iron.[245] Ranking third was basic compound armour, which had been in use since the 1870s. Compound armour derived its name from the nature of its manufacturing, which involved welding steel over a wrought iron plate.[246] When introduced, compound armour was only about 20% stronger than wrought iron, but refinement eventually produced compound armour 70% stronger than iron.[247]

Armour was applied to several crucial areas of the warship, principally along the waterline in the form of a narrow strip or, 'belt' meant to protect the sides of the ship from shots aimed to sink it. Armour was often applied to the ship's deck to prevent long range 'plunging fire' from crashing through the exposed upperworks. As we have seen from the Weapons & Ammunition chapter, major gun positions, specifically turrets, were also thickly armoured. The application of armour only to specific vulnerable areas was known as 'all or nothing' protection. Armouring in this manner possessed the principle advantage of saving weight by ignoring parts of the ship not likely to induce catastrophic

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[241] Padfield, *The Battleship Era,* 149.
[242] Ibid.
[243] Ibid., 148.
[244] Ibid.
[245] Brodie, *Sea Power in the Machine Age*, 219.
[246] Padfield, *The Battleship Era*, 84.
[247] Brodie, *Sea Power in the Machine Age*, 218.

damage if struck. To increase protection, the hull was subdivided into watertight chambers which could provide floatation if the ship were severely damaged.

How did the Combined Fleet and the Second Pacific Squadron compare with regard to armour protection? KC armour was applied to the latest warships, being as it was a fairly modern development. The Russians possessed the newest battleships, which meant that more Russian than Japanese ships carried KC armour.[248] The *Borodino* class was protected by a narrow KC belt of 7 and a half inches thickness at its greatest extent.[249] The *Osliabia*'s armour belt was shorter, "extending only over about five-sixths of her length."[250] This lack of armouring at the fore was to prove detrimental as the *Osliabia* was ultimately sunk by holes blown in these unarmoured sections.[251] It would seem that the proto-battlecruiser concept suffered from the same faults as its descendants: inadequate armour protection. The last Russian battleship of consequence, the *Sissoi Veliki*, was protected by a belt 16 inches thick (at the greatest extent) of NS armour.[252] The turret-ships were armoured with compound armour- their belts ranging from 14 to 16 inches, with the exception of the three *Admiral Ushakov* class ships, which had a 10-inch belt of Harvey armour.[253]

As for the Japanese battleships: the *Mikasa*, being the newest of the Japanese ships, was protected by a KC armour belt, but of 9 inches thickness at the greatest extent.[254] The *Shikishima* and *Asahi* were protected with similar armour belts but of

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[248] Westwood, *Witnesses of Tsushima*, 21.

[249] Gardiner, et all, *Conway's All The World's Fighting Ships: 1860-1905*, 184. See Appendix (J) for a representation of the armour fitted aboard the *Suvarov*.

[250] Westwood, *Witnesses of Tsushima*, 13.

[251] Gardiner, et all, *Conway's All The World's Fighting Ships: 1860-1905*, 182.

[252] Ibid., 180.

[253] Gardiner, et all, *Conway's All The World's Fighting Ships: 1860-1905*, 178-9 & 181.

[254] Ibid., 222.

Harvey NS rather than KC armour.[255] The *Fuiji*, being of somewhat older design, was protected by an 18 inch belt of compound armour.[256] With regards to battleships, at least, it can be seen that the Japanese possessed the thicker armour, even if only the *Mikasa* amongst them was protected by the newest armour. The barbette turrets aboard the Japanese battleships were protected by 14 inches of armour around the base- the barbettes- and 8 inches directly behind the guns.[257] Shells striking the barbette turrets in the front or at the base would be unlikely to penetrate, but shells hitting the rear might pierce the thinner armour there.

As for the armoured cruisers, all of the Russian ships were armoured with compound armour. The *Vladimir Monomakh* and the *Dmitri Donskoi* were protected by 6-inch armour belts, but the *Admiral Nakhimov* was more heavily armoured carrying a 10-inch belt.[258] As can be imagined, these obsolete ships were quite outclassed by the newer Japanese armoured cruisers, which were protected by similar thicknesses of amour, but of the Harvey NS and KC types. The armour aboard the Japanese cruisers proved to be able to withstand all but "the heaviest" shells at Tsushima.[259]

Generally speaking, the Japanese ships were better protected than the Russian ships. The main protective armour belts aboard the Russian battleships, especially, were detrimentally narrow, leaving large parts of the ships fully exposed to the effects of *furoshiki* shells. Many observers and participants have added that when the battle began,

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[255] Ibid., 221-2.

[256] Ireland, *Jane's Battleships of the 20th Century,* 66.

[257] Gardiner, et all, *Conway's All The World's Fighting Ships: 1860-1905*, 221-2. That is, 14 to 8 inches of whatever type of armour the ship was fitted with. Thus, the *Mikasa*'s turrets were protected by KC, the *Shikishima* & *Asahi* by Harvey NS, and the *Fuji* by compound armour. Ireland, *Jane's Battleships of the 20th Century*, 66.

[258] Gardiner, et all, *Conway's All The World's Fighting Ships: 1860-1905*, 186-8.

[259] Ibid., 223.

the Russian ships were overloaded with coal and supplies to the extent that the ships' armour belts were largely submerged below the waterline, making it more likely that the unarmoured sections would be hit. Semenoff is absolutely clear that he believes this point to be a myth. During the last coaling operation on May 23rd the fleet was instructed to take on only as much coal as could be burned such that by the 26th the coal bunkers would be at a "normal" level.[260] Furthermore, as coal and ammunition were expended during the battle the Russian (and Japanese) ships gradually rose higher in the water.[261] If indeed the armour belts of some ships were submerged at the beginning of the battle, those ships would have suffered the worse for it, as the Shimose explosive was more than capable of chewing up unarmoured iron.

The armour used by the Japanese, on the other hand, proved protection enough against Russian AP shells, though by no means were the ships of the Combined Fleet invulnerable to these munitions. Indeed, all of the Japanese battleships and several of the armoured cruisers suffered varying degrees of damage, the *Mikasa* and the *Shikishima* suffering the worst.[262] In the case of the Combined Fleet's older protected and unprotected cruisers, vulnerability to shellfire was even greater. The protected cruisers

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[260] Semenoff, *The Reckoning*, 477. Semenoff adds in a footnote, "How imprudently those lied who pretended that the ships had been overloaded with coal during the battle!"

[261] Westwood, *Witnesses of Tsushima*, 225.

[262] "The flagship *Mikasa*, the main target of the enemy, was hit more than 30 times. The inside of the forward conning-tower was damaged. Both bridges were struck and damaged. All the members of one gun's crew were either killed or wounded. Stacks were pierced and one gun was destroyed. The casemates and decks were damaged. Killed: 8 seamen. Wounded: 6 officers, 1 petty officer and 98 seamen. The second ship, the *Shikishima*, was struck ten times. All of one gun's crew were either killed or wounded. Tops were pierced and upper and lower decks damaged. Killed: 1 officer and 12 seamen. Wounded: 4 officers, 1 midshipman and 20 seamen. The third ship, the *Fuji*, was struck 11 times. Her hull and guns were damaged. Killed: 8 seamen. Wounded: 5 officers, 1 midshipman, 1 petty officer and 17 seamen. The fourth ship, the *Asahi,* was struck several times. Killed: 1 officer and 7 seamen. Wounded: 1 officer and 22 seamen." Japanese General Staff, "The Battle of the Sea of Japan," trans., W. Y. Hoadley (2002) <http://www.russojapanesewar.com/sea-of-japan.html> (accessed April 14, 2008). This translation claims that the fifth ship was the *Kasagi*, a protected cruiser, which is an error. The fifth ship was the armoured cruiser *Kasuga*.

Kasagi, *Naniwa*, and *Matsushima* were all crippled, the former two with waterline hits and the latter with "a damaged rudder."[263] Against the high velocity Russian AP ammunition, armour protection was imperative for the Japanese. Not to put too much stress on the point; the Japanese were also very lucky. To reiterate Westwood's point, if more of the Russian shells had succeeded in exploding, the Japanese certainly would have suffered greater losses. That said, unless the Russian guns had actually been firing *furoshiki* shells, it seems unlikely that the Russians could have emerged from the battle victorious.

[263] Westwood, *Witnesses of Tsushima*, 198-9.

Engines & Fuel.

The ongoing industrial revolution which made the ironclad age possible began at the end of the 18th century. Neo-Marxian conceptions of the past which project the entire history of civilization diametrically as pre-industrious and subsequently industrious would seem to have it about right. For better or worse, the industrial revolution continues to transform both human culture and the planet upon which we live. The steam engine made this totalizing revolution possible.

In the 17th century Thomas Newcomen and Thomas Savery designed an operational steam engine, the first of its kind.[264] In 1768 James Watt and Mathew Boulton improved the efficiency and power of the steam engine to make it available and practical for manufactures.[265] Halfway through the 19th century, the steam engine was capable of providing locomotion and electricity, and its presence enabled the increasing mechanization of production. In the naval sector, steam engines were employed in the form of paddle-steamers, and purpose built raiders. By the time of the Crimean War, the navies of all the colonial powers had all undertaken extensive conversion programs to supplement wind power with steam. From about 1850 on, the marine steam engine entered a period of "refinement".[266] The principles of the technology were well known and fairly well disseminated in both industry and transportation, on land and at sea. Nevertheless, steam did not supplant sail until the 1880s, and almost every navy maintained wind powered ships even longer.

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[264] Ramsy Muir, *A Short History of the British Commonwealth*, vol., 2, 3rd ed. (London: George Philip & Son, LTD., 1924), 121.

[265] Ibid.

[266] Robert H. Thurston, "The Steam Engine of Today," in *A History of the Growth of the Steam-Engine*, (1878) <http://www.history.rochester.edu/steam/thurston/1878/Chapter6.html> (accessed April 8, 2008).

The reasons for abandoning wind power were straightforward: steam's strategic and tactical advantage lay in its ability to free the battlefleet from the confines of the weather. This freedom made travel at sea predictable and routine. Indeed, sails were only retained for so long due to the relative difficulty of establishing strategic coaling stations around the world, and due to the poor efficiency of early steam engines. In 1835, for example, marine steam engines were capable of producing only one horsepower per ton of coal.[267] Early steam powered ships as a result could only marginally outpace their sailing rivals.[268] Moreover, steam engines needed constant attention and maintenance which entailed the active presence of engineers. Integrating steam machinery into a nation's navy thus also required a cultural and demographic change in the makeup of that navy's personnel. The accelerating industrial revolution solved the technical problem by greatly increasing the efficiency and power of the steam engine, but the issue of cultural integration would continue until the First World War.

The vertical triple expansion engine, the engine with which almost every warship at Tsushima was fitted, converted the energy stored in coal to propeller rotation in several stages. Firstly the coal was burned in large furnaces. Burning the coal produced heat, which was transmitted to boilers where the steam was actually produced. Inside the boiler, the heat from the furnaces acted upon a series of metal rods, which, being immersed in water, produced steam. The steam was funneled into a series of high and low pressure cylinders, where the major conversion from heat energy to locomotive energy took place. Inside each of the cylinders was a piston: as the steam pressure pushed through the cylinders it forced the pistons to reciprocate in an up and down motion. The

[267] Brodie, *Sea Power in the Machine Age*, 23.

[268] See Appendix (K) for a comparison of the relative speeds of various warships since the 16th century.

pistons were attached to the ship's propeller crankshaft, and thus this reciprocating action caused the crankshaft to roate which thus turned the propeller and produced thrust. Three series of side by side cylinders were utilized in the VTE engine, each bank of cylinders known as an 'expansion' and as these engines featured three expansions and were mounted vertically, the origin of the terminology becomes rather obvious.[269] At Tsushima every major warship, and most of the smaller craft as well, were outfitted with two such engines, one for each propeller.

Despite the fact that both fleets were equipped with the same machinery, one side was decidedly faster than the other. The Russians did not exceed 10 knots at Tsushima, while the Combined Fleet was able to steam at 15 knots.[270] This advantage was not as decisive as it may appear. With a faster overall speed, the Japanese could intercept the Second Pacific Squadron and pursue it. In practice, the advantage of speed kept Rozhestvenskii from escaping, but otherwise imparted no great tactical advantage upon the Japanese.[271] Nevertheless, the speed discrepancy has always appeared significant since it was one of the few areas where the Japanese held a clear advantage. This slowness was quickly attributed to an inferiority in the quality of Russian engines, which, it was noted, had demonstrated a preponderance of breakdowns during the voyage to Tsushima.

Westwood demolishes the question of Russian engine inferiority:

> The breakdowns are often cited as evidence of the technical hopelessness of the Russian ships, but wrongly so. In those days engine and steering trouble on long voyages was expected and was not confined to Russian ships. The high frequency of mishaps in the 2nd Squadron was due to the bad state of just a few ships. Two

[269] See Appendix (L) for a schematic drawing of a VTE engine.

[270] Westwood, *Witnesses of Tsushima*, 224.

[271] Schroeder, "Gleanings From The Sea of Japan," (2002) <http://www.russojapanesewar.com/gleanings.html> (accessed April 16, 2008).

> of the worst vessels (supply ships) had already been sent back to Russia, but the hastily-completed battleships *Orel* and *Borodino* had not overcome their teething troubles at this stage, and the older battleships were mechanically no better than others of their generation. Apart from the odd burst steampipe, in the subsequent battle the Russian ships' engine rooms performed well, so it seems likely that many of the mishaps called "breakdowns" en route were merely precautionary steps to attend to trouble which was incipient, anticipated, or imagined.[272]

In purely technical terms the first rates of both fleets were nearly identical with regards to power and speed. To reiterate ground covered by the chapter on Ship Designs, all the Japanese battleships could steam at 18 knots, their engines producing 15,000 horsepower.[273] The engines of the *Osliabia* and the *Borodino* class could produce 15,000 and 16,300 horsepower respectively- 18 knots for the *Osliabia* and 17 and a half for the *Borodinos*.[274] Moreover, both sides utilized the same French designed Belleville watertube boilers to provide steam.[275] These boilers have received extensive criticism for their faults- but as they were used by both fleets any errors in the design would apply to the Russians as well as the Japanese.

In short, the Second Pacific Squadron steamed slower at the battle due to its preponderance of older and underpowered ships (though during the voyage to Tsushima all of the Russian ships steamed slowly due to their heavy overloading with material and coal). Togo's advantage in speed enabled him to engage in, and withdraw from, combat at his whim. He was able to prevent the Russian fleet from escaping. Claims that Togo's advantage in speed allowed him to cross and "recross" the Russian line (crossing the 'T'

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[272] Westwood, *Witnesses of Tsushima*, 134.

[273] Robert Gardiner, et all, *Conway's All The World's Fighting Ships: 1860-1905*, 221-2.

[274] Ibid., 182 & 184.

[275] Jane, "Russian ARMAMENT AND EQUIPMENT," (1904) <http://www.russojapanesewar.com/russian-hdw.html> (accessed April 9, 2008), & Jane, "Japanese ARMAMENT AND EQUIPMENT," 1904, <http://www.russojapanesewar.com/japanese-hdw.html> (accessed April 9, 2008).

of the line, as it was known) are quite inaccurate.[276] The battle was fought primarily on "parallel courses," and any attempt made by Togo to close range was mirrored by the Russians turning away.[277] Thus, the Japanese advantage in speed made the battle possible, but did not decide its outcome.

The Russians and Japanese alike faced major fuel logistics problems leading up to the battle of Tsushima. The Second Pacific Squadron on its way to Vladivostok would require regular stops for coaling, and locally produced Russian coal was known to be of inferior quality to other suppliers in Europe. The Japanese possessed large natural coal supplies, but of even lower quality. What measures did the belligerents pursue to resolve these problems?

Japan possessed large quantities of unexploited coal at the beginning of Meiji period. Coal mining in 1868 was localized on the southern island of Kyushu, specifically the Chiku Ho district therein.[278] Under the Meiji government's "*shokusan kogyo* (develop industry, promote enterprise)" initiative, foreign experts were contracted to improve the state of the coal extraction industry, and expand operations beyond Kyushu.[279] With regards to coal, the case of Thomas Blake Glover was indicative of projects taking place across Japan. Glover was principally interested in exporting coal from the Takashima district on the island of Honshu, by expanding the traditional mining operations there. In March of 1870, Glover & Co. was producing 300 tons of lump coal a day, and planning

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[276] Oliver Warner, "Tsushima," in, *Great Sea Battles* (London: George Weidenfeld & Nicolson Ltd., 1963) 248.

[277] Evans & Peattie, *Kaigun*, 127.

[278] W. J. Macpherson, *The Economic Development of Japan 1868-1941* (Cambridge: Cambridge University Press, 1995), 33.

[279] Ibid., 30.

to expand production to 500 tons per day.[280] Though his mining operation was shortly thereafter acquired by the Netherlands Trading Society, the example of Glover indicates the potential for indigenous Japanese coal extraction if acted upon in an industrial manner.

The navy itself sought to maximize its stores of lump coal from a very early date. In 1872 the navy established a "coal supply center" in Kyushu, where lump coal was to be stored.[281] Following a nationwide survey in 1886, numerous sites were established for stockpiling coal.[282] Japanese lump coal was bituminous, meaning it contained bitumen, a tar-like substance, which when burned produced "prodigious clouds of black smoke" that were disadvantageous to flag signaling and would be highly visible to enemy ships at any distance.[283] Furthermore, unrefined lump coal was of low density and produced little heat for its volume. As such, indigenous Japanese coal was generally unsuited to naval operations. Refining the coal into briquette form would have provided a local remedy by reducing impurities and increasing density. However, Japan lacked the requisite knowledge and technology for briquette production well into the 20th century. By 1904, the Japanese had yet to master the production of suitable coal fuel.

The IJN was thus forced to import higher quality coal from abroad. Throughout the ironclad age, Great Britain represented the natural fuel supplier for any emerging navy. Indeed, until the 1880s Great Britain produced more coal "than all other nations combined."[284] British coal was also regarded highly for its superior quality.

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[280] Peter Francis Kornicki, *Meiji Japan: Political, Economic and Social History, 1868-1912* (New York: Routledge, 1998), 219.

[281] Evans & Peattie, *Kaigun*, 66.

[282] Ibid. "Nearly forty" sites were built.

[283] Ibid.

[284] Brodie, *Sea Power in the Machine Age*, 115.

The British built *Asahi* battleship had required 5700 tons of coal during its voyage from England to Japan in 1902.[285] The armoured cruisers built in England also "had eaten up an average of 4000 tons each."[286] As such, it was quite clear to the Japanese navy, a navy which had fought the Sino-Japanese War entirely on inefficient lump coal, that enormous quantities of high quality fuel would be required to fight a naval war against the world's third largest naval power.[287] Welsh Cardiff coal, generally regarded as the best in the world, was imported by the Japanese navy, and in great volumes.[288] On the eve of hostilities with Russia, the navy acquired half a million tons of Cardiff to add to their current stockpiles of 650,000 tons.[289] This large supply, well over a million tons, provided the Combined Fleet with energy throughout the Russo-Japanese War.

Russia possessed a longer history of industrialization, and could draw on greater stores of coal with which to fuel its marine steam engines. Though suffering through an economic depression during the Russo-Japanese war period, Count Sergei Witte's policies of the 1890s and early 1900s had drastically improved the productivity of Russian industry, and coal was no exception. 12 million tons of coal were produced in Russia in 1900, in comparison to the 7 million tons produced in Japan that same year.[290] Coal was mined from numerous locations across the empire.

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[285] Hough, *The fleet that had to die*, 24.

[286] Ibid.

[287] Evans & Peattie, *Kaigun*, 67. "During the Sino-Japanese War, however, in order to reduce its dependence on overseas supplies, the navy used Japanese lump coal exclusively, though this reduced the power of Japanese warships. In the event, the loss of power was not critical in facing an inferior navy…"

[288] Brodie, *Sea Power in the Machine Age*, 116.

[289] Evans & Peattie, *Kaigun*, 67.

[290] The Russian figure is from, Russian Coal, "History Coal Industry of Russia," (2007) <http://www.rosugol.ru/eng/his/index.html> (accessed April 16, 2008). The Japanese figure is from the New York Times, "Japan Has Coal to Burn," (October 26 1904).

On route to Port Arthur the Russian fleet was predicted to require "approximately a half-million tons" of coal fuel.[291] Supply would be the principle problem for this fleet. Loading half a million tons of coal aboard the warships was not an option, nor was buying coal during the voyage: "Rozhestvensky knew that no neutral power would allow him to buy coal in its ports, so he needed foreign steamers to supply the squadron with coal".[292] In 1903, the Hamburg-Amerika Line (HAPAG), a German shipping company, had approached the Russian government in search of possible business.[293] The Russians bought sixteen ships, "liners and freighters" to act as colliers for the voyage.[294] The HAPAG was also contracted to deliver "340,000" tons (338,200 tons) of Welsh Cardiff fuel to the Second Pacific Squadron.[295] Sir John Fisher, then First Sea Lord and the mind behind the HMS *Dreadnaught* was strongly opposed to supplying the Russians with British coal. He had insisted that "neutral colliers should not be loaded with British coal if the latter was destined for Rozhestvensky."[296] Little was done however to enforce Fisher's wishes, thus the HAPAG ships were able to procure Welsh Cardiff from Britain through quasi-legal means, and then deliver it the Second Pacific Squadron during the voyage.

Coaling itself was a cumbersome process. Sacks of coal had to be manhandled between boats from the supply ships to the warships, and stored below deck in coal bunkers. This process was notoriously difficult, messy, and slow. Bringing the 'collier' ships alongside the warships proved impossible given the varying heights of the warships

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[291] Lamar J. R. Cecil, "Coal for the Fleet that had to Die," in, *The American Historical Review*, vol. 69, no. 4 (July, 1964). 991.

[292] Pleshakov, *The Tsar's last armada,* 59.

[293] Westwood, *Witnesses of Tsushima*, 74.

[294] Cecil, "Coal for the Fleet that had to Die," 991.

[295] Westwood, *Witnesses of Tsushima*, 74.

[296] Ibid., 73-4. The exact number is from Cecil, "Coal for the Fleet that had to Die," 993.

and colliers.[297] To minimize the number of coaling stops the squadron had to make, coal was stored everywhere in the warships, which served to antagonize the crews of the squadron to no end.[298] The effects of this policy certainly impacted crew morale, but given the situation, there seems little Rozhestvenskii could have done differently. Over all, the HAPAG coaling project was a complete success and the Russians were well on their way to reaching Vladivostok had not the Combined Fleet intercepted them.

As both fleets were fueled by the same coal, British produced Welsh Cardiff, and powered by the same engines, the VTE engine, there can be little question of the technical equality of opposing fleets in this regard. The slowness of the Second Pacific Squadron has been attributed to a variety of factors, though there are two which are perhaps the most likely causes: Rozhestvenskii's fleet had not been properly serviced since it left Russia, and thus the undergrowth of seaweed and barnacles on the hulls of his ships dragged the entire fleet's speed down.[299] He was also burdened by the transport and service ships which accompanied the fleet, none of which were designed with speed in mind.

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[297] Westwood, *Witnesses of Tsushima*, 136.

[298] J. R. Hill, "Accelerator and brake," in, *Journal for Maritime Research*, (December 1999) <http://www.jmr.nmm.ac.uk/server/show/conJmrArticle.14/viewPage/1>

[299] Spector, *At War at Sea*, 8.

Communications & Intelligence.

This chapter will discuss both the methods of communication utilized at Tsushima, and the role intelligence gathering played just prior to the battle. Communication between ships was conducted in two primary forms. Radio telegraphy, invented by Marconi and known as 'wireless' was the principle means of sending signals between ships at distances. Flag signaling, based on running flags up mast, or via the semaphore system, was used for visual communication between ships at shorter distances. Each system possessed its benefits and drawbacks. The instantaneous long distance radio systems were vulnerable to interception by enemy radio sets, and were strictly reliant on electricity. Should a ship lose power, of have its antenna destroyed, flag signaling would have to serve. Indeed, flag signaling was put to the test early in the battle, after the *Mikasa*'s radio antenna had been destroyed in the opening salvoes. The Japanese flagship was forced to signal with flags to the *Shikashima*, which then transmitted orders to the rest of the fleet using its wireless equipment.[300] Flag signaling was notoriously slow to both transmit and comprehend, and was also reliant on the existence of suitable communication masts which were liable to be destroyed during battle. As such, the semaphore system represented the only truly reliable system for communication in battle.

The semaphore system was derived from land based telegraphic communication in the form of visual signals, often represented by flags. Systems of this nature were adopted aboard sailing warships during the late 18th and early 19th centuries, and sophisticated codes were devised to make numerous variations of message signaling

[300] Busch, *The Emperor's Sword*, 162.

possible. Eventually, maritime visual signaling systems, which had been based on running a cacophony of flags up variously positioned masts, became simplified such that a single human being could articulate entire sentences using only a pair of flags and his own arms. In the 1890s "'human' semaphore" was standardized, and indeed remains in use today.[301]

Comprehending these signals was difficult at the best of times, and the smoke and chaos produced by battle did little to improve comprehension. The semaphore system also required skilled and versed officers capable of reading and transmitting the semaphore signals. Pleshakov, for example, relates an incident aboard the *Orel* during the voyage to Tsushima, where it took the ship's captain an "hour and a half" to respond to a semaphore signal from the *Suvarov*.[302] Semenoff, flag officer on the *Suvarov*, explains that such delays may have been caused by some confusion in code books, of which the Second Pacific Squadron had been issued new copies before departing.[303] Whatever the case, these cases serve to indicate how difficult comprehending and interpreting flag signals could be. Further confusion was caused early in the battle by signal misinterpretations while Rozhestvenskii maneuvered the fleet into and out of formations.[304]

Flag signaling was also used to serve morale purposes. Togo's use of the Z flag, the famous Nelsonian signal, is one such example. A similar case occurred aboard the Russians ships; the 27th happened to be the anniversary of the Czar's coronation. St. Andrew's flag "which is also the Russian war-flag" was thus flown from the warships

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[301] Beth Derbyshire, *Message*, ed., Louise Hayward (London: Thames & Hudson, Ltd., 2006), 173.

[302] Pleshakov, *The Tsar's Last Armada*, 124.

[303] Semenoff, *The Reckoning*, 360-1.

[304] Novikoff-Priboy, *Tsushima*, 151

before the battle to encourage the sailors.[305] Rozhestvenskii had chosen to rely exclusively on flag signals at the beginning of the battle, presumably to minimize the amount of information he would otherwise be broadcasting to the Japanese if wireless were used.

The radio, making its wartime début in the Russo-Japanese War was first made practical and commercial by Guglielmo Marconi in the late 1890s. Orrin Dunlap, in his 1937 biography, *Marconi*, romanticizes the era and the man. "Marconi's triumph lives with the radio," he writes. "There may never be another genius to whom science will award the sole honor of a great discovery…".[306] Marconi's invention operated on the following principle: when an electric current is transmitted through a length of wire, that wire emits electromagnetic radiation which can take the form of radio waves. These radio waves can be received by any similar length of wire and converted to digits, letters, codes or even sound, depending on the receiving apparatus. In July of 1897, Marconi conducted a series of experiments at the behest of the Italian government to examine the capability of his invention for signaling over water. Ellison Hawks in his 1927 edition of *Pioneers of Wireless* describes this historic event:

> The transmitter-- with a vertical wire of 78ft. in length and terminating in a zinc plate-- was installed near the arsenal of St. Bartholomew, on the eastern side of the Gulf of Spezia…. The receiver was placed on board a tug-boat, moored at various distances from the shore. The vertical receiving wire on the tug was 48 ft. in height, ran to the top of the mast, and terminated in a zinc plate…. Transmission was successful up to 4 km.[307]

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[305] Novikoff-Priboy, *Tsushima*, 144.

[306] Orrin E. Dunlap, Jr. "The Birth of A Wizard" in, *Marconi: The Man and His Wireless* (New York: The MacMillan Company, 1937. Reprinted Edition 1971 by Arno Press Inc.), 3.

[307] Ellison Hawks, *Pioneers of Wireless* (New York: Arno Press, 1974), 229-30.

By increasing the height of the transmitting and receiving wires, transmissions were eventually made at 13 kilometers distance, and then at 18 kilometers when a 90 foot receiving wire was placed aboard the Italian warship *San Martino*.[308]

Marconi, as he readily acknowledged, inherited a long tradition of research and theory. His invention built on the thought and efforts of dozens of scientists and inventors who had been investigating the properties of electrical currents throughout the 19th century. Indeed, great efforts had been made by the likes of Alexander Graham Bell, Thomas Edison, Alexander Popov and Nicola Tesla among others, to produce 'wireless' communication using electromagnetic conduction, induction and radiation. Bell, encouraged by the great success of his telephone, labored to produce a wireless variant for use at sea. His method, tested on the Potomac river on December 11th, 1878, involved utilizing the water of the river to complete an electrical circuit between a pair of boats with positive and negative terminals protruding into the water.[309] Similar arrangements had been tested in water and on land throughout the 19th century.

In 1886 Edison proposed transmitting electricity between balloons floated hundreds of feet above the decks of ships.[310] Building on his work with wireless train signaling, Edison conceived of powerful induction coils theoretically capable of transmitting electrical currents to ships "many miles apart".[311] In 1891, John Trowbridge proposed inducing currents between ships via tall antennae. Trowbridge faced insurmountable technical difficulties however, which served to highlight the improbability of successfully communicating wirelessly at great distance by the induction

[308] Ibid., 230.
[309] Ibid., 105.
[310] Hawks, *Pioneers of Wireless*, 147.
[311] Ibid.

method. For example, communications conducted at the relatively short distance of half a mile would require induction coils "with a radius of 800 ft."[312]

While experimenting in Colorado in 1898, Tesla actually managed to achieve some of the results Trowbridge had theorized about.[313] As Tesla explained, his research was "almost entirely confined to alternating currents of high potential" with the goal of transmitting energy wirelessly.[314] In 1891 at Columbia University, Tesla had succeeded in producing electromagnetic radiation at specifically tuned frequencies- tuning being absolutely essential to successful wireless communication. Nevertheless, Tesla possessed little interest in producing a commercial form of wireless communication, and while his work on tuning had been pioneering, he did not pursue that line of research to a systematized commercial conclusion.[315]

Another innovator who must be mentioned is the Russian, Alexander Stepanovich Popov, who developed the first Russian naval radio sets. Popov worked for the Krondstadt Torpedo School, and had succeeded in producing a rudimentary wireless apparatus in 1895.[316] Hawks considers Popov's device "very similar" to that ultimately adopted by Marconi.[317] Popov's device, sporting an aerial wire of 18 meters in height and capable of transmitting up to five kilometers, was nevertheless limited by its insensitive detecting apparatus.[318] Popov did ultimately produce a naval variant which was fitted aboard Russian warships. By the time of Tsushima, however, the Popov variants had been replaced with sets made on German design. Semenoff did not hold these Slaby-Arco

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[312] Ibid., 127.
[313] Ibid., 210.
[314] Dunlap, *Marconi: The Man and His Wireless*, 101.
[315] Ibid., 33.
[316] Hawks, *Pioneers of Wireless*, 202.
[317] Ibid., 203.
[318] Ibid., 204.

wireless sets in high esteem, despite the claims of the Slaby-Arco firm.[319] For example, the Slaby-Arco sets were supposed to function out to 500 miles, but had never been shown to operate at any range greater then 65 miles.[320] A few of the Russian ships did carry Marconi sets, for example the mine sweeping tug *Roland* was thus fitted, as were the auxiliary cruisers *Korea* and *Kitai*.[321]

The Japanese navy adopted radio technology with enthusiasm. In 1903 every major warship in the Japanese navy was fitted with radio equipment.[322] These were homegrown Type 36 radios, devised by the Japanese Navy Ministry which could not afford to import Marconi sets.[323] These Type 36 radios had proved capable at ranges of 70 miles during tests in 1901.[324] It can be seen thus that both fleets enjoyed similar capabilities of range with regard to their wireless apparatuses.

During the battle, radios were employed extensively. Wireless communications were intercepted by both sides. The radio room of the *Aurora*, for example, "was receiving Japanese messages all the time" to the annoyance of the Russian crew.[325] Earlier in the war, a Russian lieutenant stationed at Vladivostok, Boris Dolivo-Dobrovolskii, had proposed "a new system of wire interception, code breaking and jamming" for use against the Japanese navy.[326] The Russians later put these methods to the test during sorties of their cruiser squadron from Vladivostok. It would seem however, as the aforementioned anecdote of Japanese radio flooding would indicate, that

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[319] Semenoff, *The Reckoning*, 282-3.
[320] Ibid., 362. See Appendix (M) for an image of a Russian radioroom.
[321] Ibid.
[322] Evans & Peattie, *Kaigun*, 84.
[323] Ibid.
[324] Ibid.
[325] Westwood, *Witnesses of Tsushima*, 200.
[326] Evgeny Sergeev, *Russian Military Intelligence in the War with Japan, 1904-05* (New York: Routledge, 2007), 96.

these methods of jamming and interception were not practiced by the Second Pacific Squadron. Maintaining coordination in the Squadron would have been quite difficult with confusing signals coming in from the Japanese warships during the battle. That said, powerful local signals (such as those communicated by the Russian battleships) tended to overpower the signals being propagated by the Japanese warships, and thus one should not overestimate the handicap the Russians suffered through their lack of adequate jamming methods. Presumably the Japanese faced similar problems, receiving Russian signals as well. Radio had also played a significant role in actually beginning the battle, for it was with radio communication that Togo's scouts reported the position of the Second Pacific Squadron as it steamed towards the Sea of Japan.

Naval intelligence, of which scouting and communication is an integral part, is the subject least written on with regards to the Battle of Tsushima. John Keegan's recent *Intelligence in War* mentions the battle only in passing, with no reference whatsoever to the vital role intelligence played at the battle.[327] Nevertheless, the gathering of intelligence was absolutely crucial to the battle's outcome: there would have been no conflict had Togo's scouts failed to find the Second Pacific Squadron as it attempted to pass through the mist obscured straits the morning of the 27th.

Rozhestvenskii's failure to deploy scouts was a crucial error. Rozhestvenskii had personally decided not to conduct reconnaissance before passing through the Straits of Tsushima.[328] He made this decision on the basis of the mist that was obscuring the straights the evening of the 26th. He believed any scouts he dispatched would have failed

[327] John Keegan, *Intelligence in War* (London: Hutchinson, 2003), 65.
[328] Sergeev, *Russian Military Intelligence in the War with Japan, 1904-05*,149.

to find much of anything, let alone return to their formation safely.[329] As it happened, visibility on the 27th was cut down by "haze" and "mist" and later in the evening by fog.[330] It has been suggested that Rozhestvenskii did not dispatch scouts because he was an obstinate admiral, determined to drive his entire squadron to its doom. "His insistence on yellow funnels" writes Westwood, "would seem to support those who alleged that he was a blockhead."[331]

Why did Rozhestvenskii make no attempt to scout the Tsushima Straits? Some have suggested that he believed the squadron's only chance of reaching Vladivostok lay in staying united, even to the exclusion of dispatching scouts.[332] It seems more likely, however, that Rozhestvenskii believed he had already alluded the Combined Fleet, before entering the Straits.

> There is no doubt that the Baltic Fleet when it entered the Straits of Tsushima believed the bulk of the Japanese navy to be behind it and the way to Vladivostok to be barred only by a certain number of torpedo craft and cruisers, through which in the fog it had a fair chance of passing unobserved. Mr. Jane holds that Rojestvensky's formation in two battle lines was a sound enough one, in view of attacks from small craft only, while on the other hand it was so obviously and hopelessly bad against a battle fleet attack that it seems of itself conclusive evidence that Rojestvensky never expected to meet Togo when he did.[333]

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[329] Ibid.

[330] Evans & Peattie, *Kaigun*, 118-9.

[331] Westwood, *Witnesses of Tsushima*, 229. It seems entirely possible that Rozhestvenskii refused to allow the tall yellow funnels of his warships to be repainted because he believed the visibility and identification advantage would be of greater use to his squadron than to the Japanese. The incident at Dogger Bank, where several of the Squadron's warships opened fire on some British fishing boats during a night engagement under the belief these were Japanese cruisers and torpedo boats, would attest to the need for easily recognizable identification markings, especially once an engagement had progressed to the point where smoke would obscure the entire fleet. Pleshakov, *The Tsar's Last Armada*, 289.

[332] Pleshakov, *The Tsar's Last Armada*, 289.

[333] New York Sun, "Why The Russians Lost in the Recent War," (August 1906) <http://www.russojapanesewar.com/nysun.html> (accessed Feb., 14, 2008).

The fact that Rohzestvenskii immediately reformed his fleet into a single line once the Combined Fleet appeared, confirms the perspective espoused above.[334] Taylor agrees, stating that the "imperfect battle formation" Rozhestvenskii's fleet took as it entered the straits indicated that the Russian admiral did not expect to encounter the entire Combined Fleet there.[335] One learns from David Walder that, in an uncharacteristic act of "subterfuge" Rozhestvenskii had ordered the majority of his supply ships and colliers to steam away from the Squadron before entering the straits presumably to draw off some the of Japanese warships.[336] When the Russian fleet actually entered the straits, Rozhestvenskii ordered radio silence, further indicating his hope of alluding the Japanese altogether.[337]

Obviously Rozhestvenskii's efforts were not successful. Indeed, the Japanese had devised an entire system for patrolling the Sea of Japan, where sections "ten minutes of latitude and longitude each" were swept by Japanese merchant ships and cruisers.[338] Though Rozhestvenskii could not have known it, there was little chance of avoiding these patrols, even with favorably poor weather. In the event, the Japanese cruiser *Shino Maru* spotted the Second Pacific Squadron in the early morning of the 27th and sent an encoded radio message to the *Itsukishima* which proceeded to relay the message to *Mikasa*. Togo received the news that the Second Pacific Squadron had been spotted at 5am, and radioed Tokyo to inform the Japanese government.[339]

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[334] Evans & Peattie, *Kaigun*, 118.

[335] Taylor, *The Japan-Russia War*, 554.

[336] Walder, *The short victorious war; the Russo-Japanese conflict, 1904-5*, 278. & Tyler, *The Japan-Russia War*, 526.

[337] Walder, *The short victorious war*, 278-9.

[338] Pleshakov, *The Tsar's last armada*, 264.

[339] Busch, *The Emperor's Sword*, 133-5.

Evgeny Sergeev's recent book *Russian Military Intelligence in the War with Japan, 1904-5*, dedicates only two pages to discussing Tsushima, however he agrees with Westwood's position. Sergeev believes Rozhestvenskii, having little choice given the weather, acted appropriately when he decided not to send scouts.[340] Nevertheless, the cynic cannot but point out that had Rozhestvenskii dispatched scouts, and succeeded in locating the Combined Fleet, the battle may never have been fought.

[340] Pleshakov, *The Tsar's last armada*, 264.

Conclusions.

This paper has argued that the quality of ammunition, to the exclusion of all other factors, including crew quality, was the decisive factor at the Battle of Tsushima. I would hypothesize that the decisive nature of the *furoshiki* ammunition still has not yet been generally accepted due to an overwhelming historical discourse which initially portrayed the Russians at Tsushima as inferior sailors and leaders. After the battle, both Rozhestvenskii and Nebogatov were court-martialed in an attempt to pin blame upon human, rather than technical, failure. During the Cold War a second myth was constructed which conceived of the Russian equipment as antiquated, compounding the romantic teleological belief that the Second Pacific Squadron was doomed from its inception. This fleet, supposedly, was officered and crewed by incompetent men, and composed of ships not fit for battle. Careful analysis demolishes these myths, and thus the time seems apt to state conclusively the reason for the Japanese victory.

To reiterate, I believe the Japanese were victorious because they attacked the manpower of the Russian fleet, and did so with overwhelmingly superior ammunition. The *furoshiki* shells, fitted with their Shimose explosive, succeeded in resurrecting a feature of the naval campaigns of the Napoleonic Wars- the use of specially tailored ammunition to inflict maximum damage to the 'soft' parts of the warship. In 1805, this meant attacking, particularly, the crew and sailing rig. [341] Anti-crew and anti-rig munitions were to be found in the form of grape and chain shot, with a variety of derivatives.[342] One hundred years before Tsushima the principle behind the use of these munitions had been to "overwhelm enemy *men*" by destroying the areas where the crew

[341] See Appendix (P)

[342] Gardiner & Lavery, "Ammunition and Equipment," in *The Line of Battle: The Sailing Warship 1650-1840* (London: Conway Maritime Press, 2004), 157-8.

operated (in the rigging, at the wheelhouse, along the gun decks, and so on), or by killing the crewmen outright.[343]

Applied to the 20th century, similar methods forced the gunners and crewmen aboard the Russian ships to fight under the conditions of an artillery barrage the likes of which the famed German artillerist of the First World War, Colonel Bruchmuller, would have found inspirational.[344] Georg Bruchmuller developed a systemization of artillery which involved overwhelming the soldiers on the receiving end of a barrage with "short, violent, [and] intensive" shelling, intended to produce maximum psychological effects during the first few hours.[345] Bruchmuller preferred to employ gas shells, which provided all the suppressive effects he required without counterproductively ripping up the battlefield landscape. In some regards, the incapacitating fumes produced by the Shimose explosive resembled a proto-gas weapon. However, these comparisons should not be taken to far, for the contextual difference between the pre-modern Battle of Tsushima, and the thoroughly modern First World War are vast. Nevertheless, it is enlightening to consider that Bruchmuller's very successful method was tailored to produce results "during the first few hours" through a 'hurricane barrage' and that in the case of Tsushima, the Japanese "hail of fire" decided the battle within the first hour.[346]

If human agency is to attributed at all, the deciders of the battle would be Shimose Masakazu, whose innovative explosive turned the Second Pacific Squadron to tinder, or Ijuin Goro, whose fuse made every Japanese shell a lethal shrapnel bomb. At least from

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[343] Padfield, *The Battleship Era*, 106. Italics in original.

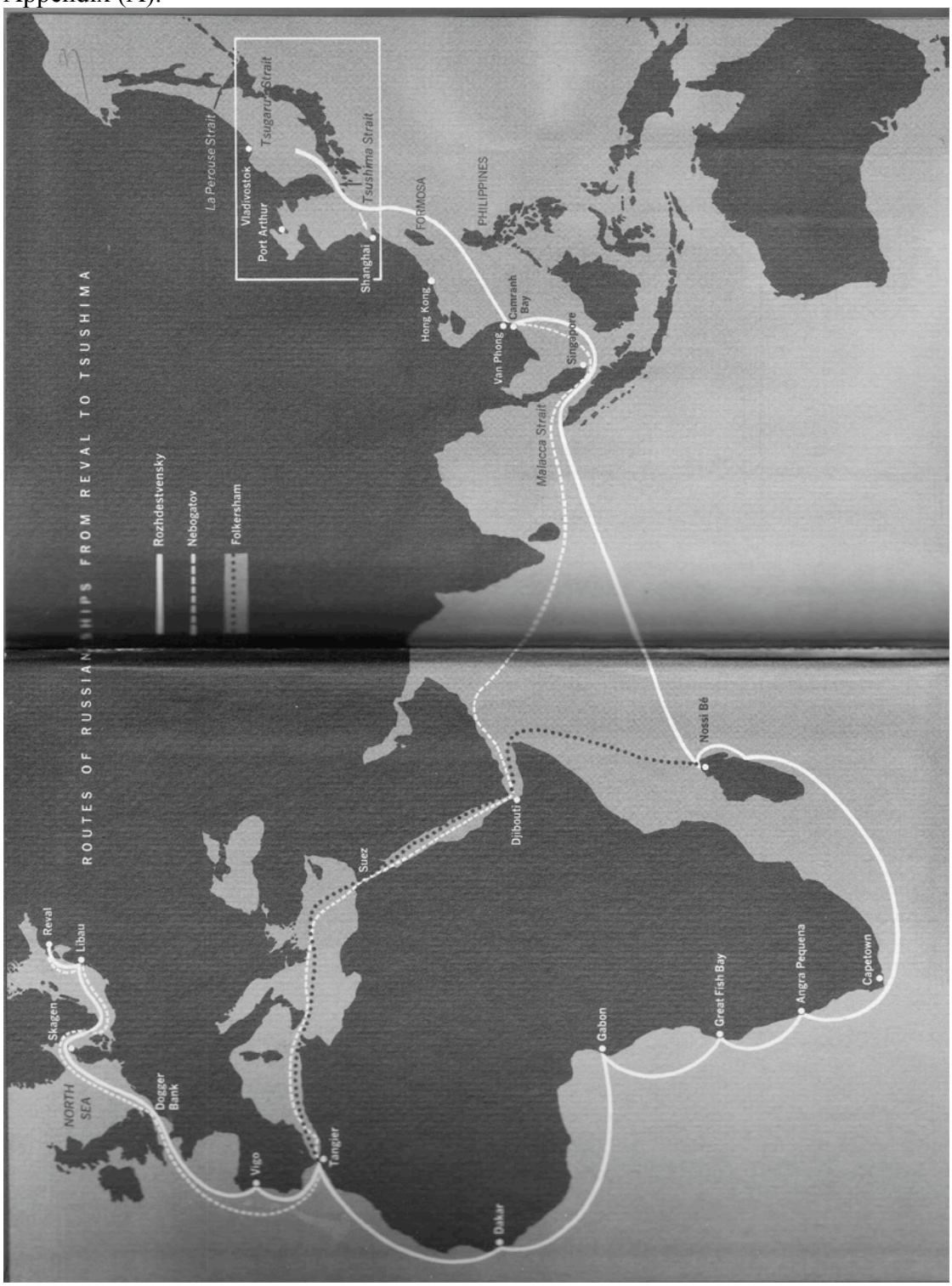
[344] For information on the Bruchmuller method consider, David T. Zabecki, *Steel wind: Colonel Georg Bruchmuller and the birth of modern artillery* (Westport, Conn.: Praeger, 1994).

[345] Zabecki, *Steel wind*, 34.

[346] Padfield, *The Battleship Era*, 181. Westwood puts it this way: "after the first hour of battle Togo had been merely exploiting his advantage." Westwood, *Witnesses of Tsushima*, 223.

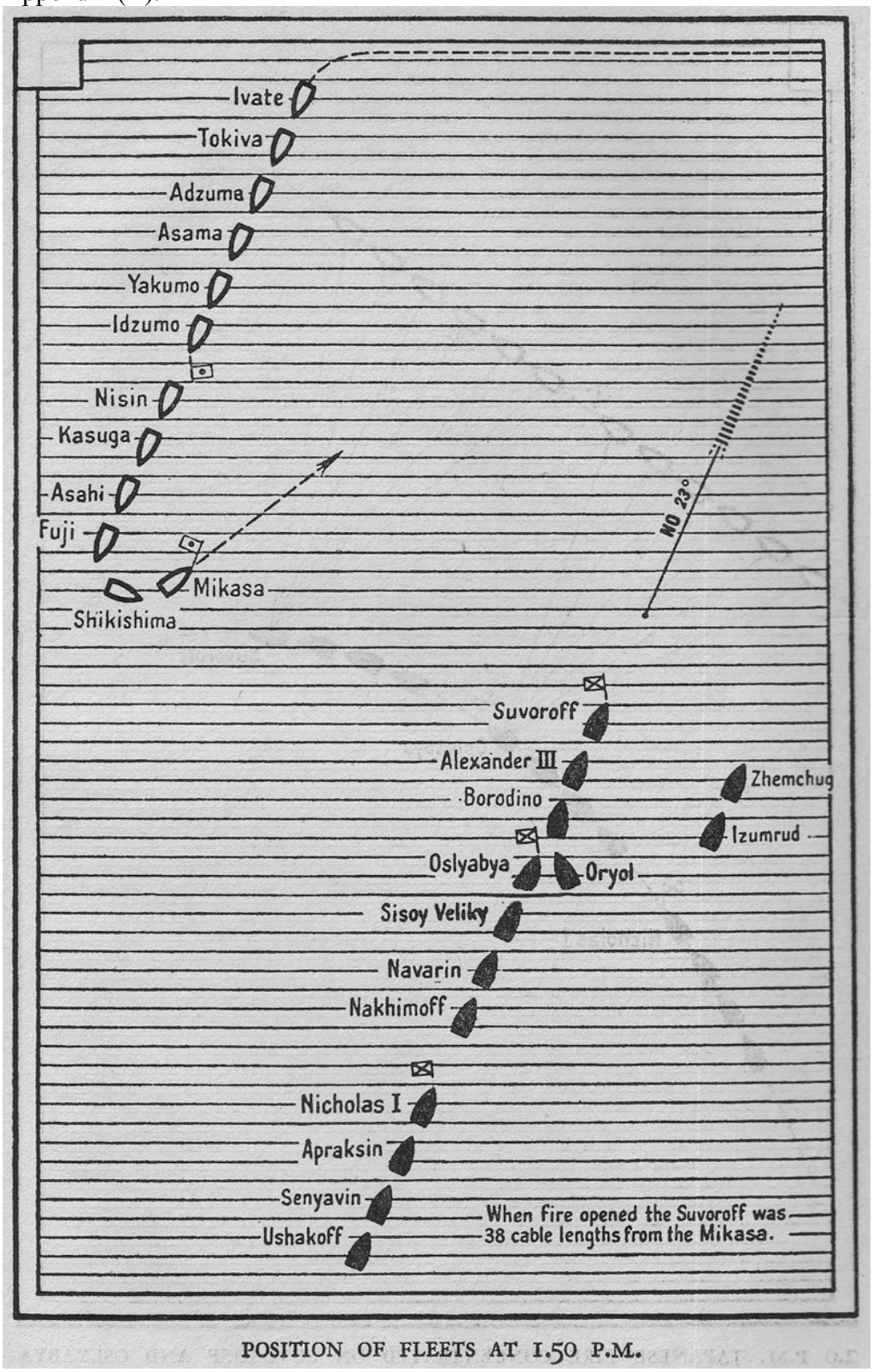
the technical perspective the sum of these innovators' work, the *furoshiki* shell, was the battle winning product. It is time history recognizes that fact.

Appendix (A).



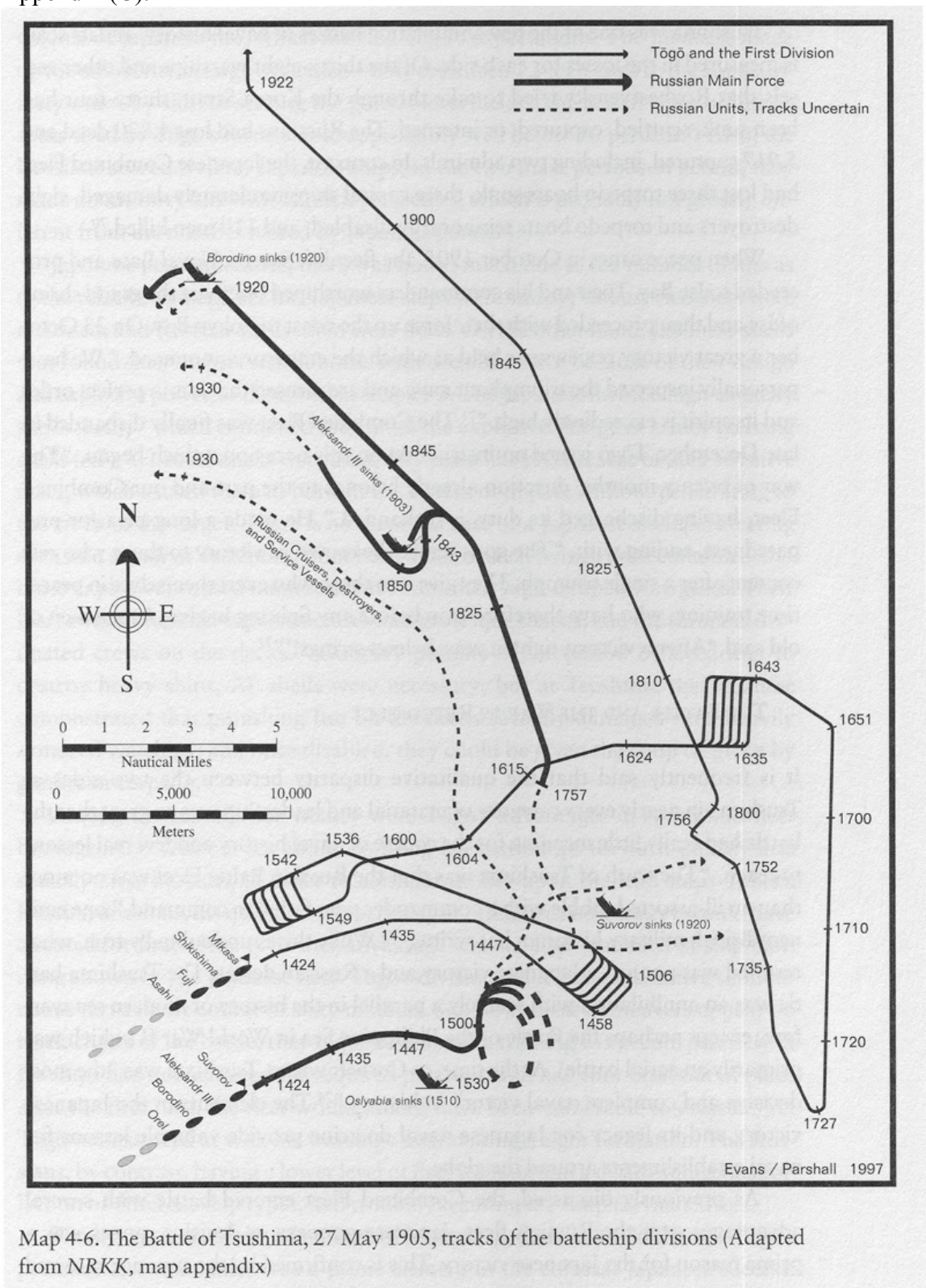
"Routes of Russian Ships from Reval to Tsushima" in Noel Fairchild Busch, *The Emperor's sword; Japan vs Russia in the Battle of Tsushima* (New York: Funk & Wagnalls, 1969), frontpiece. The white line representing the Second Pacific Squadron terminates at the location of Nebogatov's surrender.

Appendix (B).



Map showing 'the Turn' from A. Novikoff-Priboy, *Tsushima*, trans., Eden & Cedar Paul (New York: Alfred A. Knopf, 1944), 423.

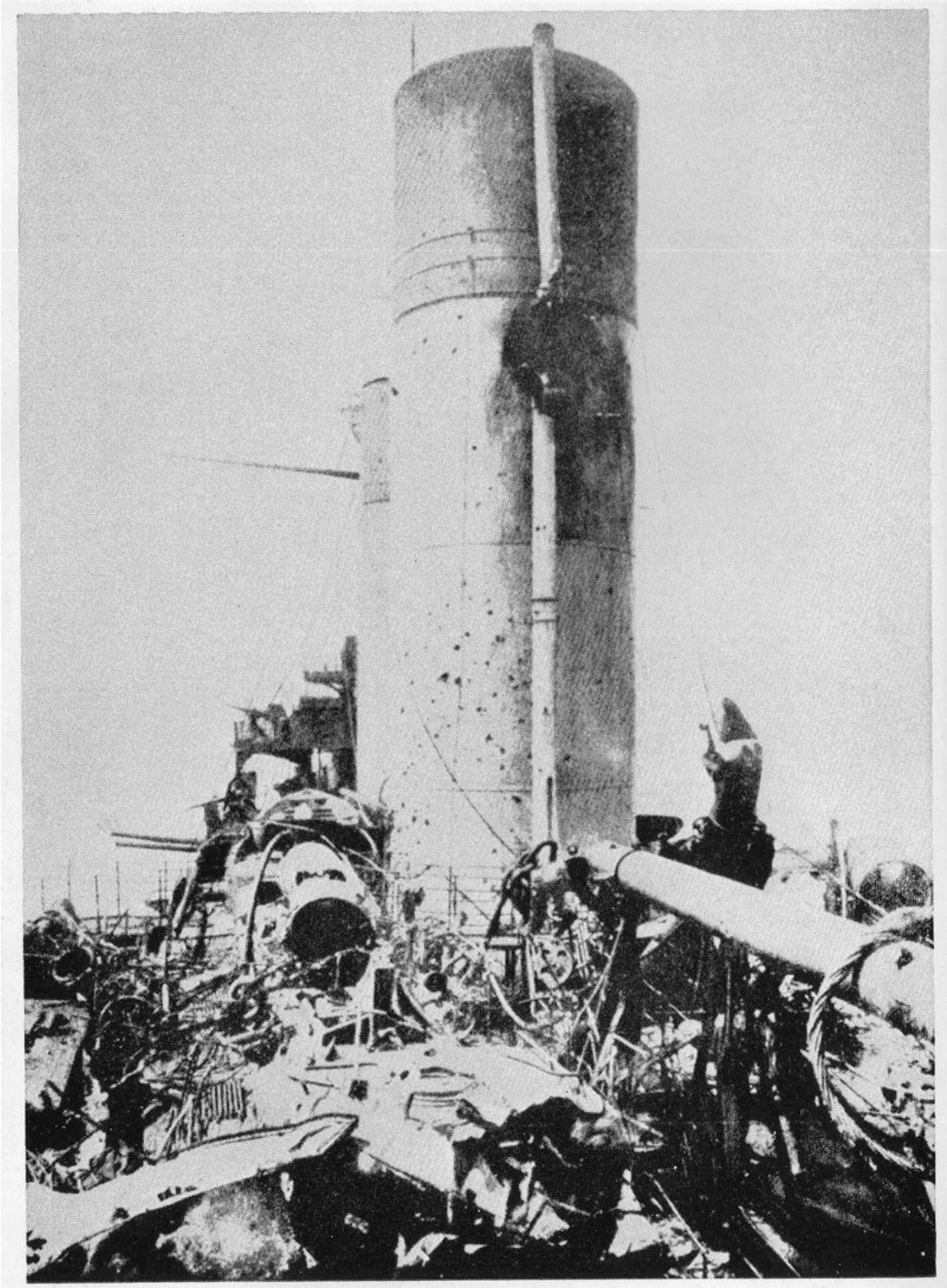
Appendix (C).



Map 4-6. The Battle of Tsushima, 27 May 1905, tracks of the battleship divisions (Adapted from *NRKK*, map appendix)

Map from, David C. Evans & Mark R. Peattie, *Kaigun: Strategy, Tactics, and Technology in the Imperial Japanese Navy, 1887-1941* (Annapolis: Naval Institute Press, 1997), 123.

Appendix (D).



The upper deck of the Russian battleship *Oryol* after Tsu-Shima

Photograph from Richard Hough, *The fleet that had to die* (New York: Viking Press, 1958).

Appendix (E).

The Japanese Combined Fleet

First Squadron

First Division:
Mikasa (Mikasa class OBB) Flag of Admiral Togo
Shikishima (Shikishima class OBB)
Fuji (Fuji class OBB)
Asahi (Asahi class OBB)
Kasuga (ex-Italian Mitra class CR)
Nisshin (ex-Italian Roca class CR) Flag of Vice Admiral Misu
Tatsuta (Tatsuta class CS) *dispatch vessel*

Attached Flotilla's

1st Destroyer Division:
Harusame (Harusame class ODD) Broad Pennant of Captain Fujimoto
Fubuki (Harusame class ODD)
Ariake (Harusame class ODD)
Arare (Harusame class ODD)
Akatsuki II (ex-Russian Puilki class ODD)

2nd Destroyer Division:
Oboro (Ikazuchi class ODD) Broad Pennant of Captain Yajima
Inadzuma (Ikazuchi class ODD)
Ikazuchi (Ikazuchi class ODD)
Akebono (Ikazuchi class ODD)

9th Torpedo-boat Division:
Aotaka (Aotaka class TB) Broad Pennant of Commander Kawase
Kari (Aotaka class TB)
Tsubame (Aotaka class TB)
Hato (Aotaka class TB)

Third Division:
Kasagi (Chitose class OCR) Flag of Vice Admiral Dewa
Chitose (Chitose class OCR)
Otowa (Otowa class OCR)
Niitaka (Tsushima class OCR)

Attached Flotilla

4th Destroyer Division:
Asagiri (Harusame class ODD) Broad Pennant of Commander Suzuki
Murasame (Harusame class ODD)
Shirakumo (Shirakumo class ODD)
Asashiwo (Shirakumo class ODD)
Note: *Each vessel was carrying 8x100lbs. Mines*

Second Squadron

Second Division:
Idzumo (Idzumo class CR) Flag of Vice Admiral Kamimura
Adzuma (Adzuma class CR)
Tokiwa (Asama class CR)
Yakumo (Yakumo class CR)
Asama (Asama class CR)
Iwate (Idzumo class CR)
Chihaya (Chihaya class CS) *dispatch vessel*

Attached Flotilla's

5th Destroyer Division:
Shiranui (Murakumo class ODD) Broad Pennant of Commander Hirose
Murakumo (Murakumo class ODD)
Yugiri (Murakumo class ODD)
Kagero (Murakumo class ODD)

3rd Destroyer Division:
Shinonome (Murakumo class ODD) Broad Pennant of Commander Yoshijima
Usugumo (Murakumo class ODD)
Kasumi (Akatsuki class ODD)
Sazanami (Ikazuchi class ODD)

Fourth Division:
Naniwa (Naniwa class OCR) Flag of Rear Admiral Uriu
Takachiho (Naniwa class OCR)
Akashi (Suma class OCR)
Tsushima (Tsushima class OCR)

Third Squadron

Fifth Division:
Itsukushima (Matsushima class OCR) Flag of Vice Admiral Kataoka
Chinyen (ex-Chinese Chen Yuan class OBB)
Matsushima (Matsushima class OCR)
Hashidate (Matsushima class OCR) Flag of Rear Admiral Taketomi
Yaeyama (Yaeyama class CS) *dispatch vessel*

Attached Flotilla

11th Torpedo-boat Division:
Number 73 (Number 67 class TB) Broad Pennant of Lieutenant-Commander Fujimoto
Number 72 (Number 67 class TB)
Number 74 (Number 67 class TB)
Number 75 (Number 67 class TB)

Sixth Division:
Suma (Suma class OCR) Flag of Rear Admiral Togo Masaji (no relation)
Chiyoda (Chiyoda class CR)
Akitsushima (Akitsushima class OCR)
Idzumi (ex-Chilean Esmeralda class OCR)

Attached Flotilla

10th Torpedo-boat Division:
Number 43 (Number 39 class TB) Broad Pennant of Lieutenant-Commander Odaki
Number 42 (Number 39 class TB)
Number 40 (Number 39 class TB)
Number 41 (Number 39 class TB)

15th Torpedo-boat Division:
Hibari (Aotaka class TB) Broad Pennant of Commander Kondo
Sagi (Aotaka class TB)
Hashitaki (Aotaka class TB)
Uzura (Aotaka class TB)

The Russian Second and Third Pacific Squadrons

First Division:
Knyaz Suvorov (Borodino class OBB) Flag of Vice Admiral Rozhdestvenski
Imperator Alexandr III (Borodino class OBB)
Borodino (Borodino class OBB)
Orel (Borodino class OBB)

Second Division:
Oslyabya (Peresvyet class OBB) Flag of Rear Admiral Baron Felkerzam
Sisoi Veliki (Sisoi Veliki class OBB)
Navarin (Navarin class OBB)
Admiral Nakhimov (Admiral Nakhimov class OBB)

Third Division:
Imperator Nikolai I (Imperator Alexandr II class OBB) Flag of Rear Admiral Nebogatov
General Admiral Apraxin (Admiral Ushakov class OBB)
Admiral Senyavin (Admiral Ushakov class OBB)
Admiral Ushakov (Admiral Ushakov class OBB)

Attached Cruisers

Zhemchug (Izumrud class OCR)
Izumrud (Izumrud class OCR)

First Cruiser Division:
Oleg (Bogatyr class OCR) Flag of Rear Admiral Enkvist
Aurora (Pallada class OCR)
Dmitri Donskoi (Dmitri Donskoi class CR)
Vladimir Monomakh (Vladimir Monomakh class CR)

Second Scouting Division:
Svyetlana (Svyetlana class CR) Broad Pennant of Commodore Shein
Ural (ex-Kaiserin Maria Theresia class AMC)

Destroyer Flotilla

1st Destroyer Division:
Byedovi (Boiki class ODD)
Buini (Boiki class ODD)
Bravi (Boiki class ODD)
Buistri (Boiki class ODD)

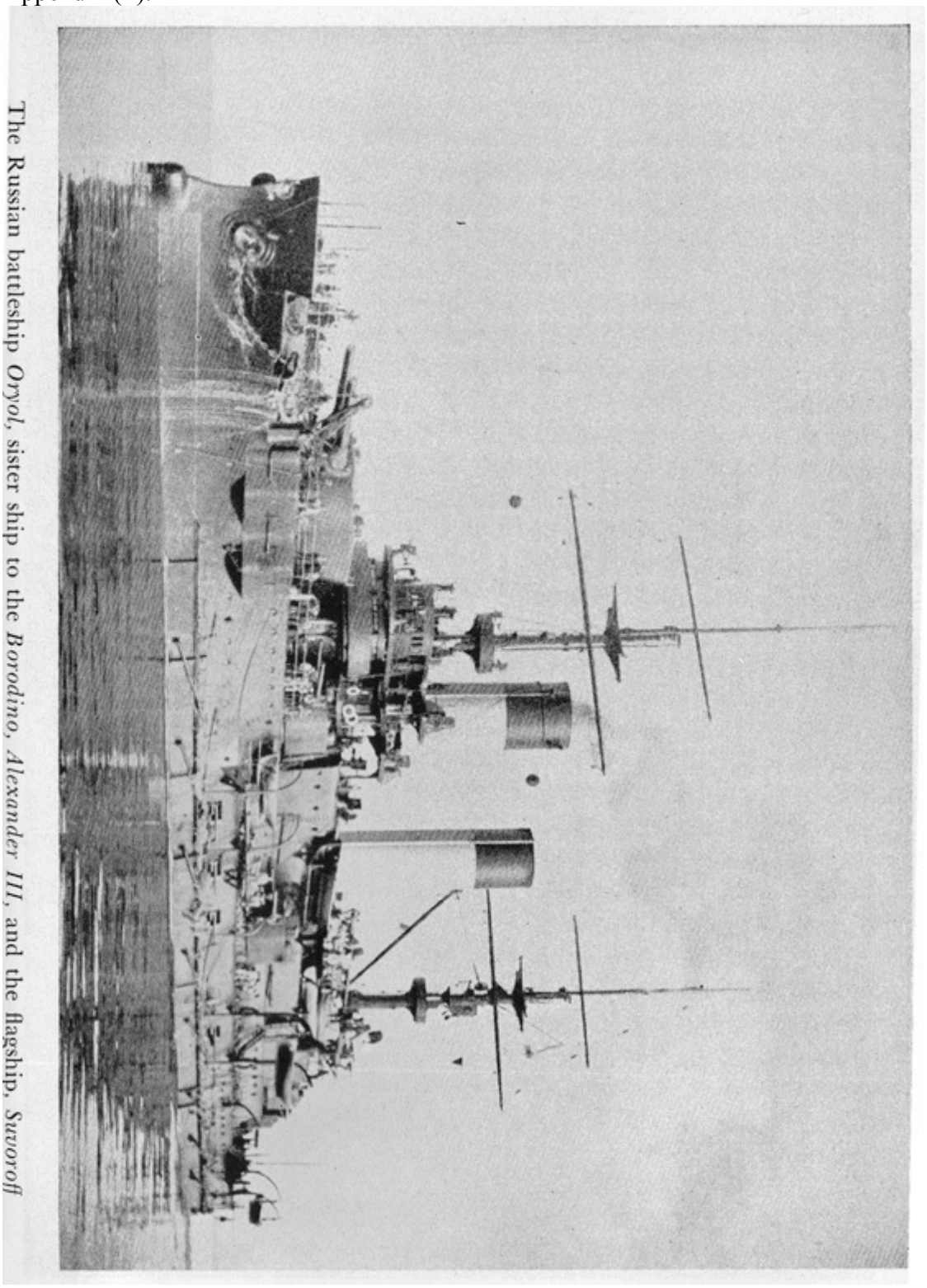
2nd Destroyer Division:
Blestyashchi (Boiki class ODD)
Bezuprechni (Boiki class ODD)
Bodri (Boiki class ODD)
Gromki (Boiki class ODD)
Grozni (Boiki class ODD)

Transport Squadron

Almaz (Almaz class PY) Broad Pennant of Captain Radlov
Anadair (ex-Franche Comte class AP)
Irtuish (ex-Belgia class AP)
Kamchatka (Kamchatka class AR)
Koreya (Koreya class AE)
Rus (ex-Verein class AT)
Svir (ex-Zwartezee class AT)
Orel (Volunteer Fleet steamship class AH)
Kostroma (Volunteer Fleet steamship class AH)

"Fleets of 1905- Fleet list for the Battle of Tsushima." From, The Russo-Japanese War Research Society, <http://www.russojapanesewar.com/1905-Fleets.pdf> (2002).

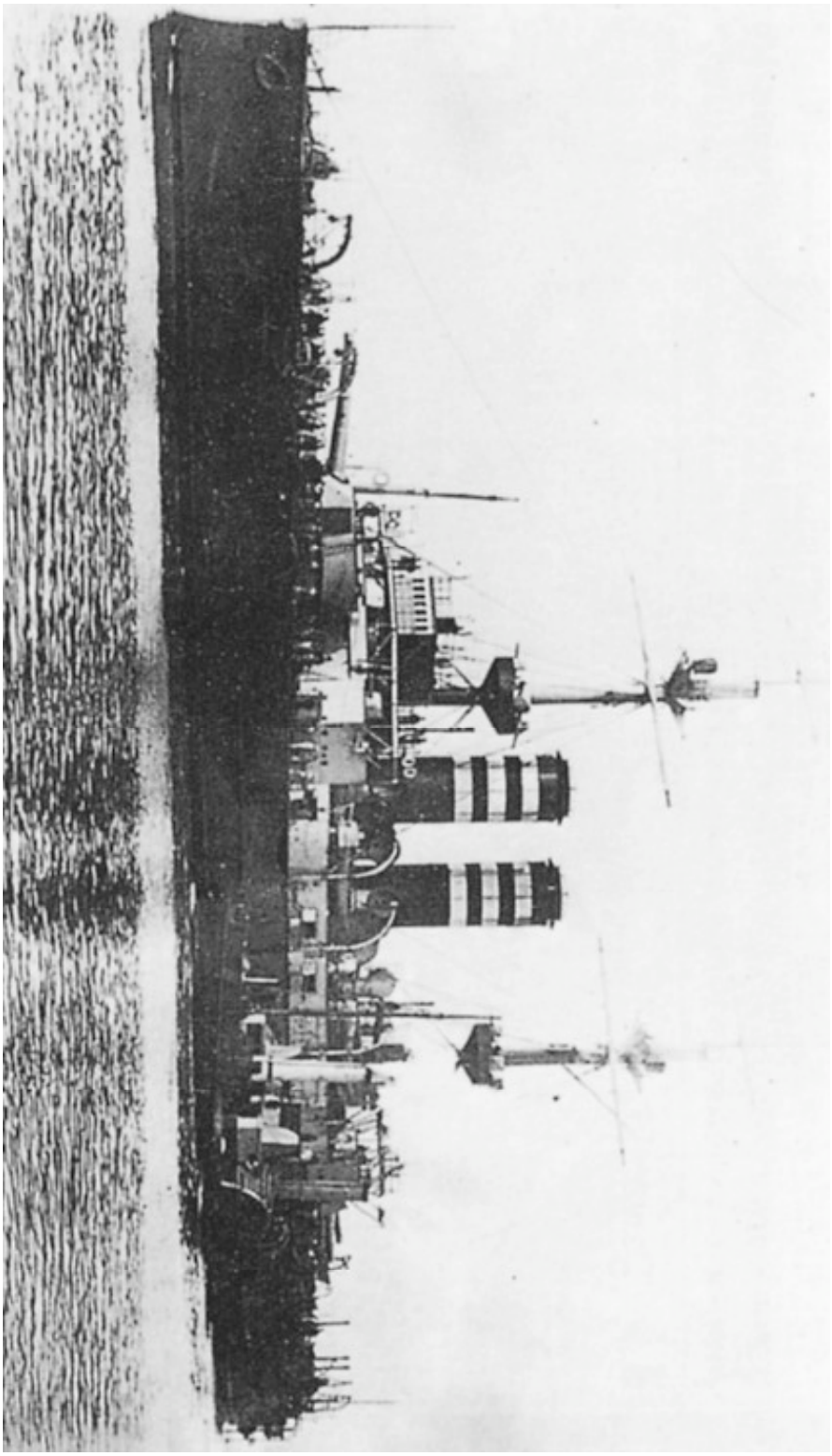
Appendix (F).



The Russian battleship *Oryol*, sister ship to the *Borodino*, *Alexander III*, and the flagship, *Suvoroff*

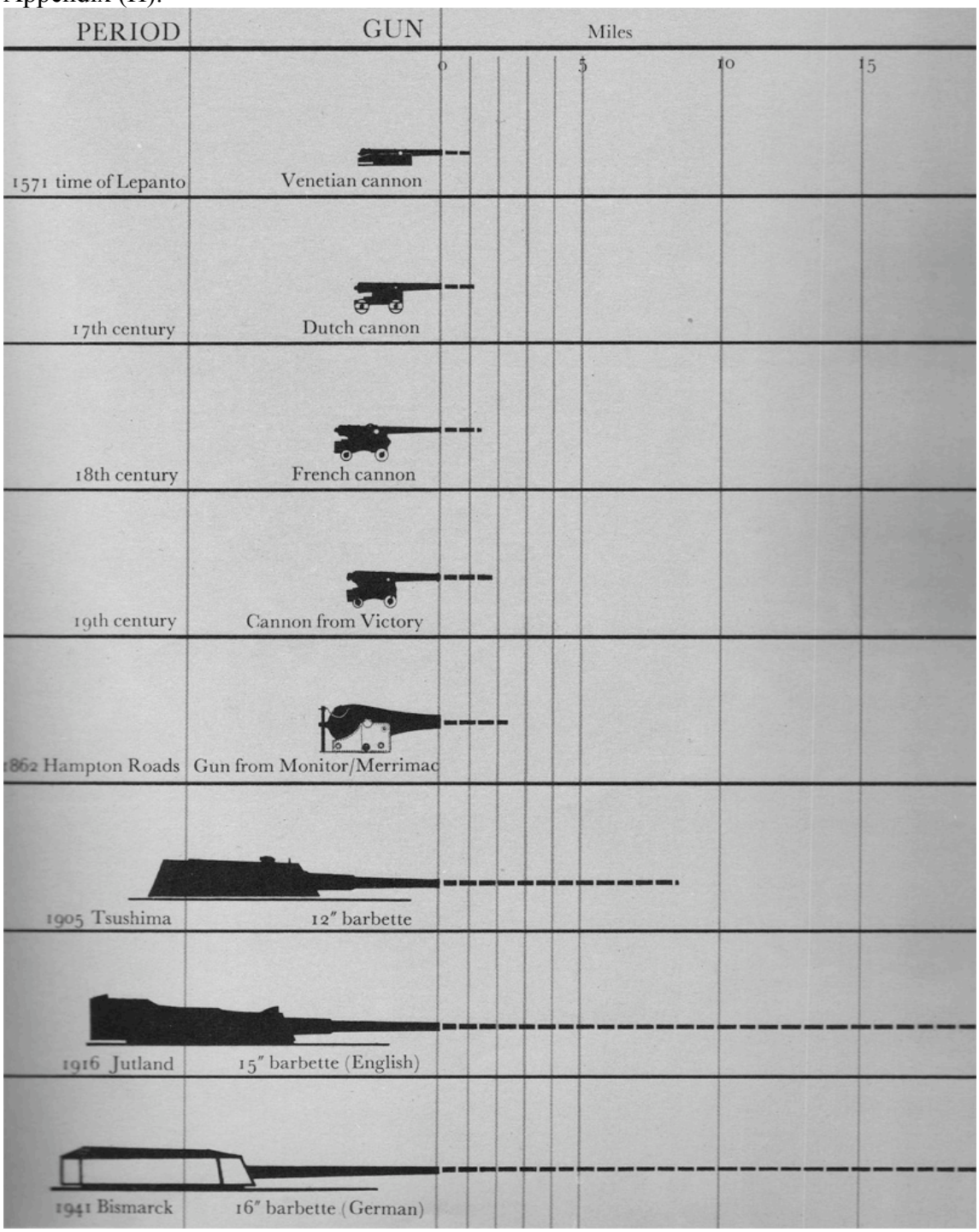
Photograph from Richard Hough, *The fleet that had to die* (New York: Viking Press, 1958).

Appendix (G).



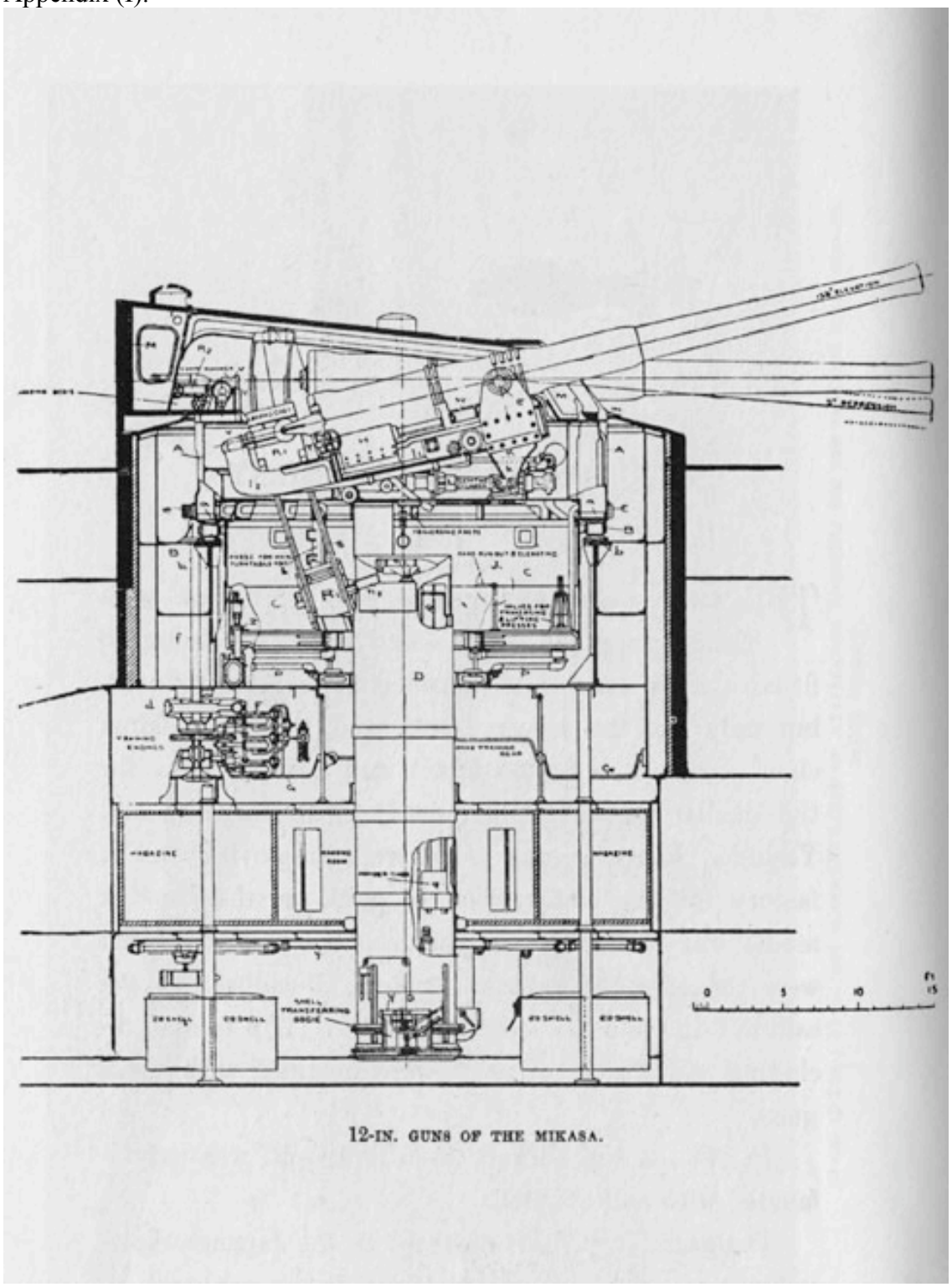
"HIJMS Mikasa," from <http://www.naval-history.net/WW1NavyJapanese.htm> (accessed April 9, 2008).

Appendix (H).



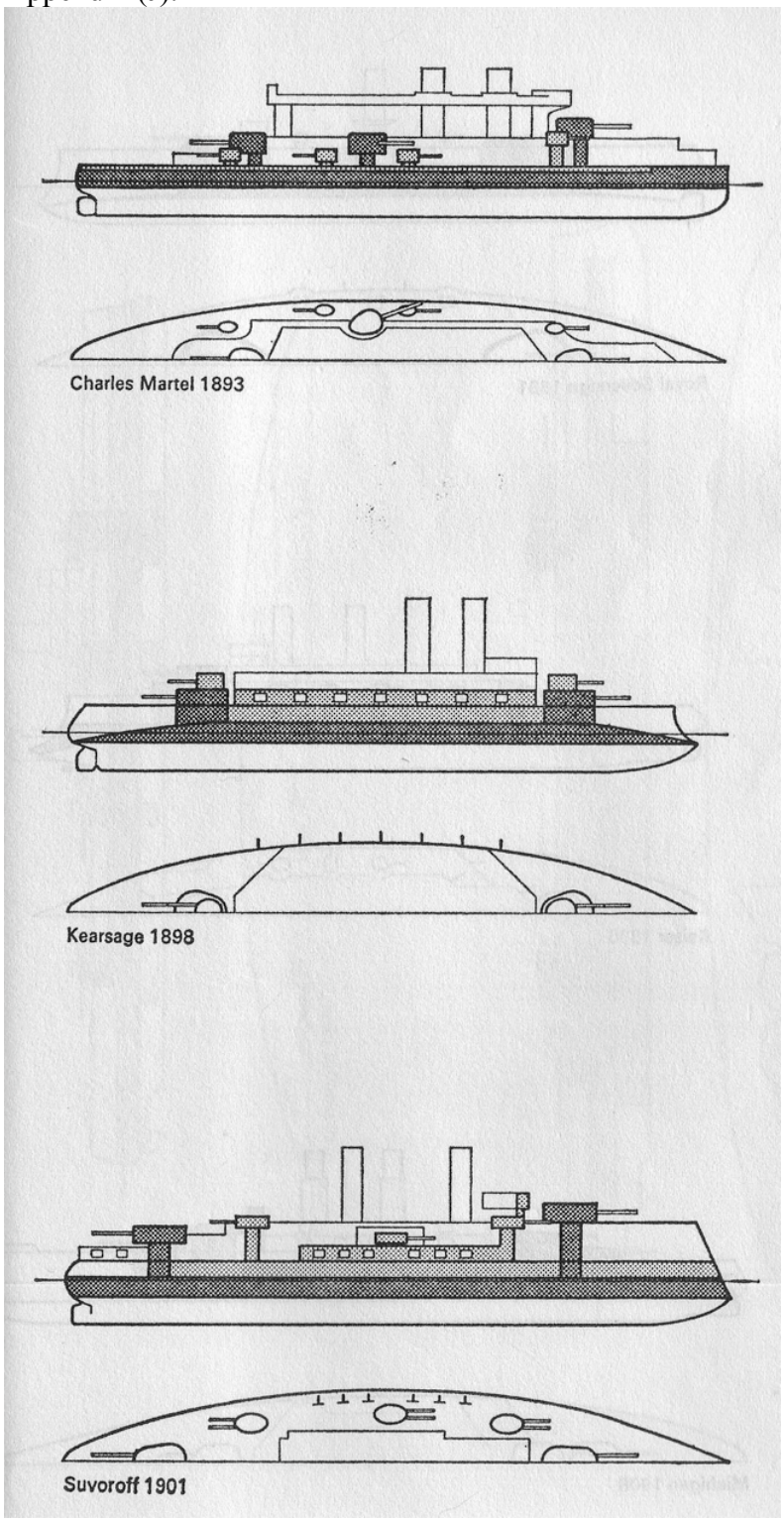
"The Range of Guns, 1570-1942" in, Oliver Warner, *Great Sea Battles* (London: George Weidenfeld & Nicolson Ltd., 1963), 13. The chart is truncated (maximum ranges for the "Jutland" and "Bismarck" are shown as 35,000 yards).

Appendix (I).



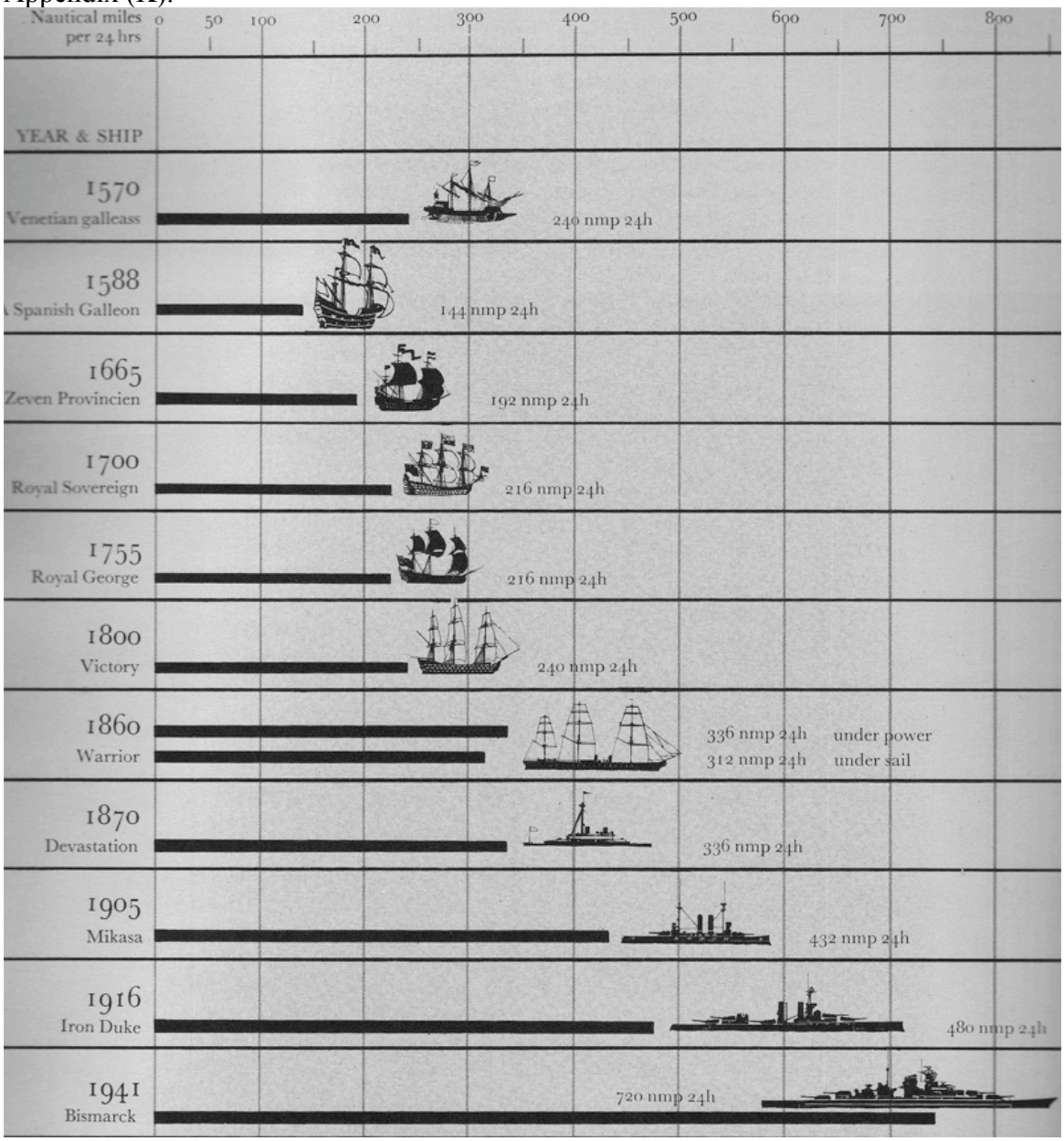
"12-in. guns of the Mikasa" From, The Russo-Japanese War Research Society, <http://www.russojapanesewar.com/images/hardware/12in-mikasa.jpg> The black lines indicate the barbette turret's armouring.

Appendix (J).



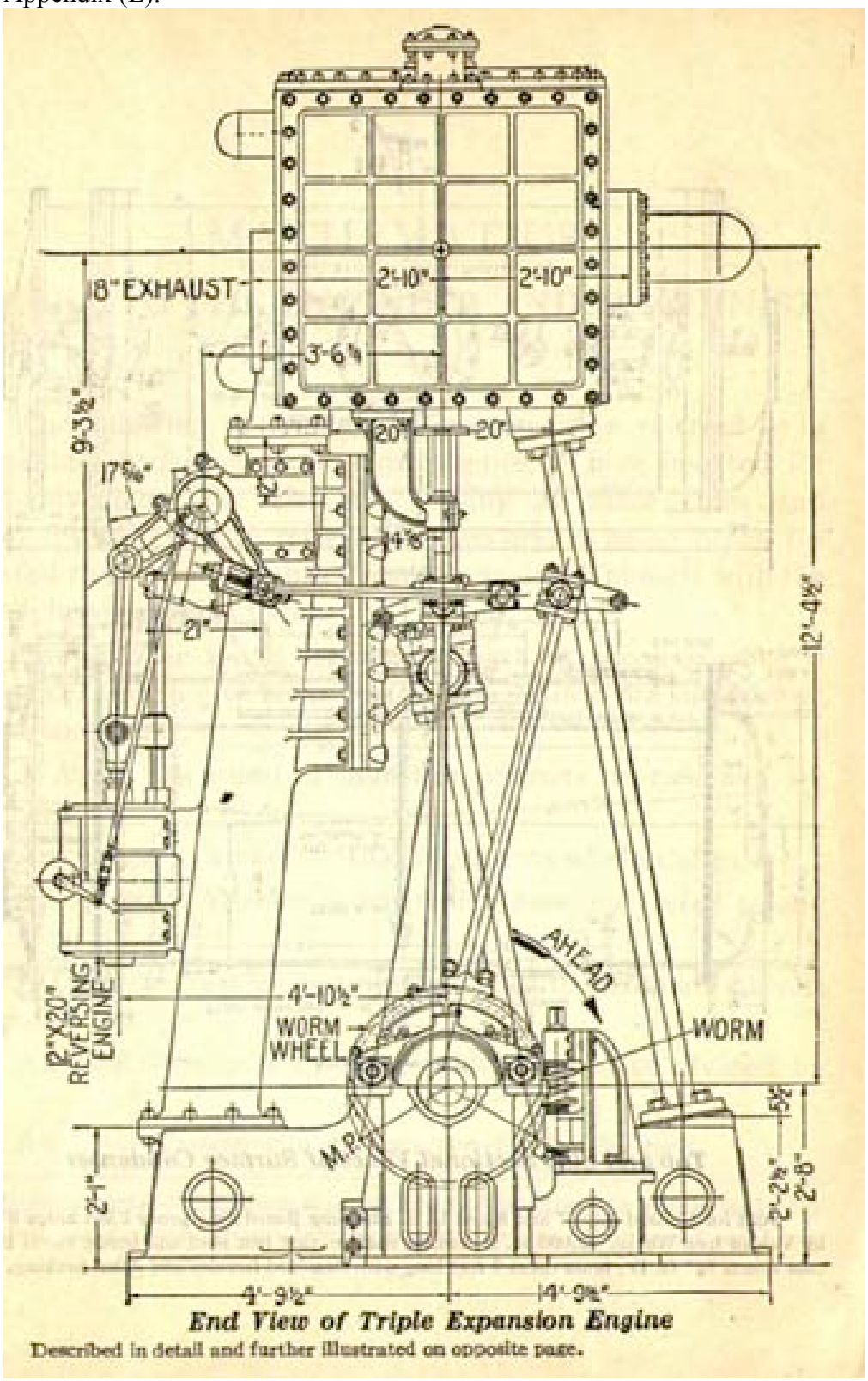
Peter Padfield, *The Battleship Era* (London: Granada Publishing Ltd., 1972), Appendix. Showing the armour protection on the *Suvarov*, the Russian flagship at Tsushima. Notice the similarities with the French built *Charles Martel* at top, specifically the cylindrical turret armour.

Appendix (K).



"The Speed of Ships, 1570-1942," in, Oliver Warner, *Great Sea Battles* (London: George Weidenfeld & Nicolson Ltd., 1963), 12.

Appendix (L).



"End View of Triple Expansion Engine," in, M. Hanley, *Triple Expansion Steam Engines*, 28 December 1997, <http://www.carferries.com/triple/>

Appendix (M).

Plate 20 The reception of radiograms on board a Russian battleship.

"Plate 20" in, Evgeny Sergeev, *Russian Military Intelligence in the War with Japan, 1904-05* (New York: Routledge, 2007). Presumably this is a radio of the Slaby-Argo type.

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