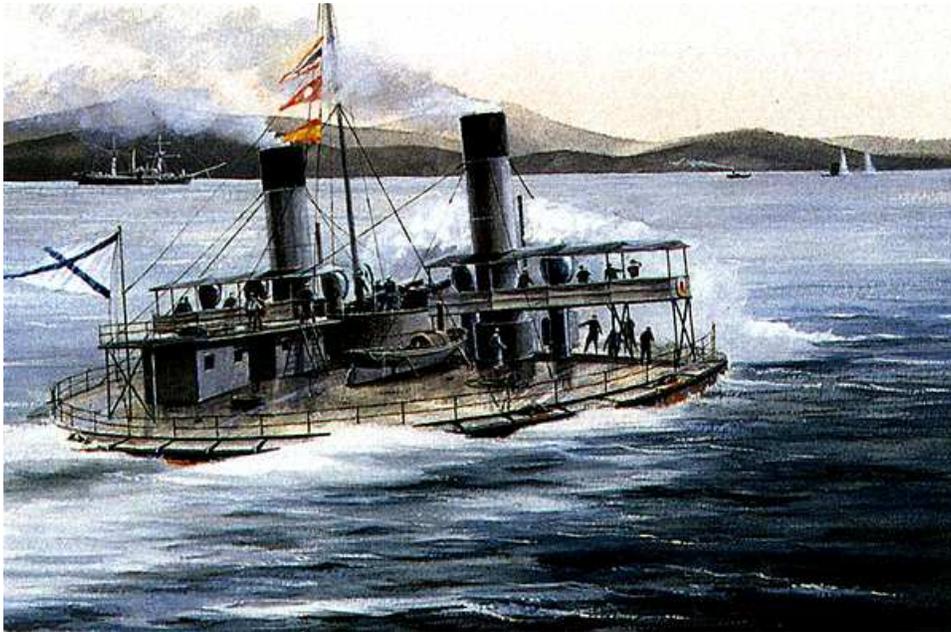


A WELL-ROUNDED WARSHIP DESIGN



THE PROMISE OF WHICH RAN VIRTUAL CIRCLES AROUND ITS PITIFUL ACTUAL PERFORMANCE

INTRODUCTION: The practicality of iron-clad warships was first demonstrated during the Crimean War (1853-1856); almost a full decade before the USS MONITOR and the CSS VIRGINIA fought to a draw. As might be expected, there were a profusion of differing designs for similar vessels developed during the second half of the 19th century.

The majority of such designs were based on the USS MONITOR's characteristics. Some were improvements; others were failures. Eventually, as improved warship designs were created, the class of ships dubbed monitors was discarded by the world's navies.

Imperial Russia had been on the receiving end of a bombardment during the Crimean War by three French floating batteries that were iron-clad armored. Not fitted with any propulsion equipment, they had to be towed into action. But once within range they quickly destroyed several Russian forts with impunity. It was a lesson learned that led Russia to pursue a home-grown monitor design, albeit one that was steam-powered.

To say the Russian design approach was radical would be an understatement. The two vessels they built during the 1870's were completely round, with their beams having the same dimension as their lengths. Often called the ugliest warships ever built, fatal flaws in their basic design also rendered them unmanageable in any sea-going application. They provide an intriguing example of a lesson learned...and one best not repeated.

ANDREI ALEXANDROVICH POPOV (1821-1898): Popov was initially a line officer in the Imperial Russian Navy. He served during the Crimean War and years later became a noted naval designer. By 1870 he had attained the rank of Read Admiral and placed in charge of all of Russia's warship design and construction work.

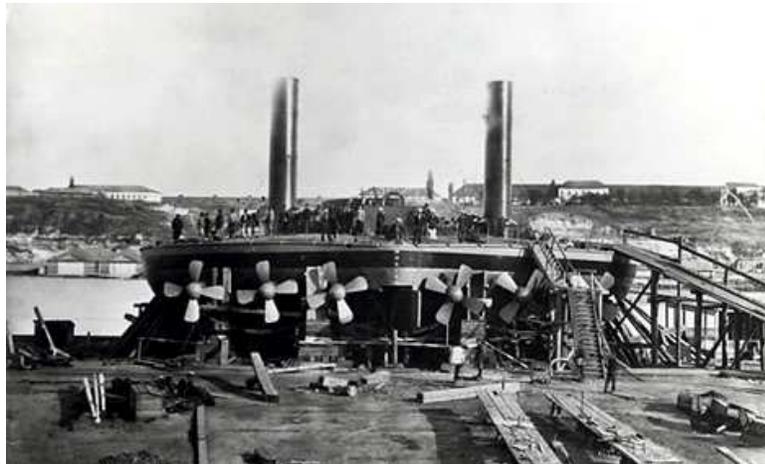


The perceived advantage of a circular hull form was that a shallow-draft vessel would be more stable than a round-bottomed ship in coastal waters. Plus, such a design would permit mounting heavier guns than a conventional ship of similar displacement could handle.

Popov utilized a test tank for experiments with a model of a round warship. He then had a larger model, really a miniature ship, built to further test the concept. This model was 24-feet in diameter and was tested on the Neva River in 1870. The round design showed promise, perhaps in part because of the protected waters used for his scaled-up experimental model. But the model had neither guns nor propulsion machinery.

Popov's design was chosen as the first armored warship design to be employed in the Black Sea. The original decision was to build ten vessels to his design for use as armored, steam-powered batteries or floating forts in the Black Sea. A collective nickname, 'Popovkas' was applied to the proposed class of ship, honoring their chief designer.

THE POPOVKAS: The first of these vessels was laid down in 1872. Named for the ancient and historic Russian city of Novgorod, she was built in a St. Petersburg shipyard in sections, which were transported by rail to Sevastopol on the Black Sea for final assembly. The NOVGOROD is shown here at an advanced stage in her construction. She was completed in 1874.

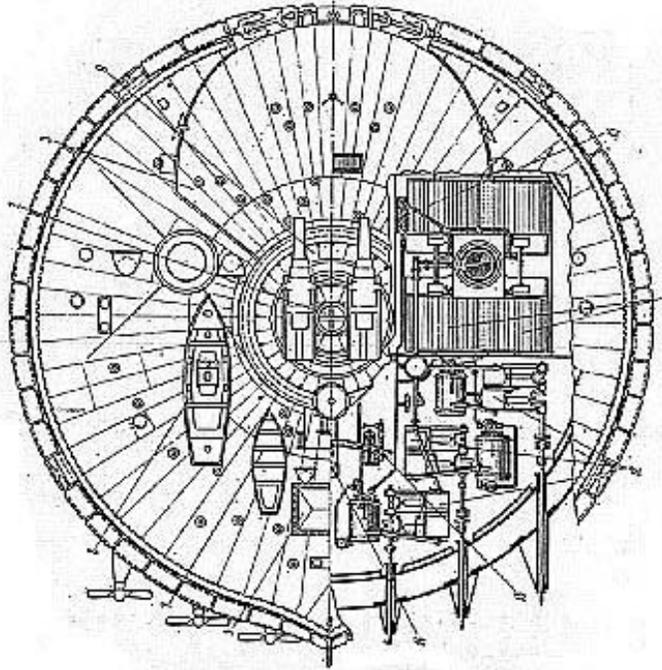


Typically, the length and beam dimensions of any vessel are amongst the first to appear in any table of characteristics. In the case of the NOVGOROD, it didn't matter which! Instead of identifying such normal parameters, the first of the Popovkas is best described as having a diameter of 101 feet. Or, for the purist, her length and beam were the same dimension. Equally unusual, she was fitted with six propellers; clearly visible in the above vintage photograph.

Other parameters that describe this odd craft are ones more recognizable to marine designers. Her full load displacement was 2,671 tons, resulting in a draft of 13 ½ feet. She was fitted with eight coal-fired boilers and six horizontally mounted, compound reciprocating steam engines that developed a combined shaft horsepower of 3,000.

Each of her six engines was directly connected to a separate propeller shaft. Her sextet of propellers protruded from beneath the protective overhang of her hull. The NOVGOROD's eight boilers and six engines occupied roughly half of the space beneath her main deck, leaving relatively little room for her crew of 150.

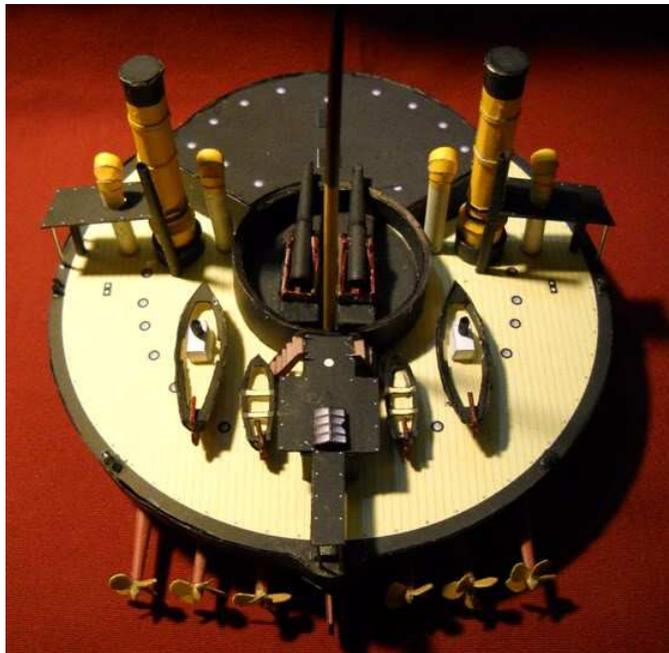
Other unusual features included a small rudder and the absence of any kind of protruding keel. She was truly a flat-bottomed vessel and had a low freeboard of just over five feet.



Her main armament, mounted on a raised platform, consisted of two 11-inch muzzle loading cannons that each weighed 26 tons. Their supporting platform could rotate to aim both guns together, or separately. Twin large funnels and multiple ventilators impeded the aiming of the guns, however.

The guns were partly recessed in a barbette made of 9-inch thick wrought iron. But the barbette was entirely open above, making it vulnerable to falling ordinance.

The vessel's only enclosed superstructure consisted of a pilot house quarters for her senior officers; located aft of the twin cannons. The NOVGOROD's hull was fitted with a belt of armor that varied in thickness from 11 to 9 inches. The vessel's main deck was relatively lightly armored; only 2.3 inches thick.



Initially, ten of these 'saucer ships' were envisioned. However, only one other, slighter larger version of the NOVGOROD was ever constructed. Excessive cost and underperformance were to blame for that. The name REAR ADMIRAL POPOV was bestowed on the second and last of the Popovkas, which was commissioned in 1875.

OPERATIONAL DEFICIENCIES: Once placed in service Russia's 'Popovkas' quickly exhibited several serious flaws. They were expected to have a top speed of seven knots. The best either could muster was two to three knots.

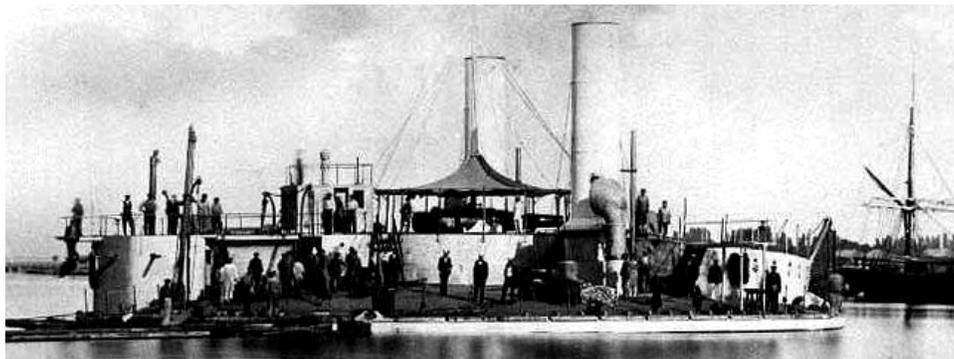
Of course, there was the normal expectation that they could steam in a straight line. But the vessels' flat-bottomed design made them vulnerable to cross currents and tidal surges. Each vessel's single rudder proved woefully undersized to counteract such forces.

Because of their relatively shallow draft, they pitched and rolled excessively in any sea state except flat calm. In addition to being uncomfortable for their crews, such erratic movements made accurate gunnery impossible. Their low freeboard made them 'wet' ships, further adding to the discomfort of their crews.

But the worst characteristic realized was the effect of firing one of these ship's 11-inch guns. The resultant off-axis recoil of weapon imparted a centrifugal rotation to the entire vessel. With no keel to stabilize the ship, it would begin to spin like a top. Putting the rudder 'hard over' to counteract the forceful recoil proved ineffective, as did attempts to contra-rotate some of the propellers to resist rotation.

An enlarged rudder and a dozen longitudinal bilge keels were retrofitted a few years after the vessels were placed in service, but these additions did little to improve their sea-keeping characteristics. However, crew habitability was improved somewhat by the expansion of living spaces atop their low profile hulls. But ventilation was poor and they became virtual ovens during Ukrainian summers.

In 1892, the Russian Admiralty reclassified both vessels as Coastal Defense Armor-Clad Ships and restricted their use to floating batteries, and they spent a large percentage of time anchored at the entrance to Black Sea harbors or pierside. They served in this limited capacity until 1903 when they became storeships. They were scrapped in 1912.



LIVADIA: Apparently not bothered by the poor performance of Popov's two circular warship creations, Tsar Alexander II had his 'designer admiral' create a royal yacht that was largely based on the same principles of hull construction.



Popov's modified design included a more conventional bow and stern. The result was an odd and somewhat oblong hull shape that was 235 feet in length, with a beam of 153 feet. A large and lavishly furnished superstructure was provided.

Like its predecessors, it had a shallow draft. Consequently, LIVADIA did not handle rough seas much better than Popov's first creations.

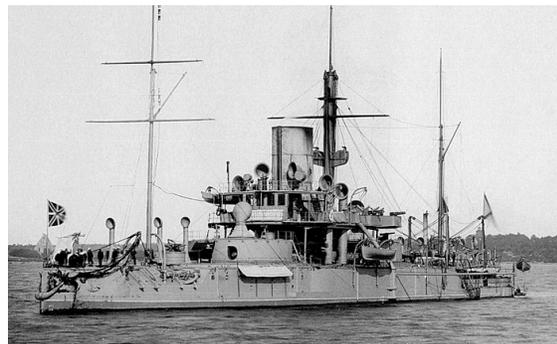
The yacht was fitted with ten boilers that exhausted to three funnels, mounted athwartship. Three steam engines separately drove a like number of propellers. A more conventional rudder arrangement was provided. Her design speed was 14 knots, but no information could be found as to her actual performance.

Built in Scotland and delivered in 1881, the exquisitely appointed LIVADIA was used just one time as a yacht. Actually, less than one time! Her delivery trip proved to be a nightmare. In the Atlantic, and even in the calmer waters of the Mediterranean, her crew of 260 was perpetually seasick.

By the time the vessel had staggered into Constantinople, members of the Russian royal family that had gone onboard in Scotland had already abandoned ship when she had stopped in Spain. Just days after the yacht reached Sevastopol, the Tsar was assassinated. The fate of LIVADIA was soon sealed.

During the ensuing revolt in Russia, the yacht's finery was stripped away and she spent the next half century ingloriously serving as a coal barge in the black Sea. Eventually abandoned at Odessa, she lay rusting until 1927, when her remains were scrapped.

Andrei Popov avoided any reprisal for his costly marine design failures and peacefully passed away in 1898 at age 76. Lest history judge him too harshly, Popov had a successful naval career before turning to design. And he did create several conventional and successful warships designs, such as this 9,000 ton battleship.



MORE MONITORS: Numerous warships that were classified as monitors, but which featured more conventional hull designs than Popov's circular creations were designed and built during the late 19th and early 20th centuries. Their principle characteristics were similar. They all featured a shallow draft and heavy armament in turrets. And they almost all exhibited poor seaworthiness.

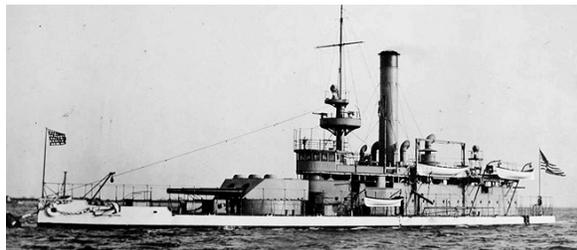
Nevertheless, the British, in particular, favored their use and even constructed two such vessels in 1943. These monitors were 373 feet long, had a displacement of almost 10,000 tons and mounted two 15-inch guns of the type used in the Royal Navy's battleships. They both participated in the pre-landing bombardment of the Normandy Beachhead in 1944, and were not decommissioned until 1954.



The American Navy, following the introduction of the USS MONITOR, constructed and placed in service a total of seventy monitors. The majority of these warships looked very much like the MONITOR and were built during the Civil War years.

As the design matured, and evolved into larger ships of this general classification, they began to appear more and more like conventional naval vessels. But they still featured low freeboards and were relegated to coastal defense duties. The last four US Navy monitors were constructed at the beginning of the 20th century.

The lead ship of the Arkansas-class was constructed at Newport News Shipbuilding as NNS Hull #26. Delivered in 1902, ARKANSAS was the only monitor built in Newport News. She was 255 feet long, with a beam of 50 feet and had a draft of 15 feet.



Displacing 3,180 tons, the ARKANSAS' main armament was two 12-inch guns mounted in a single turret. One innovation she enjoyed was the first installation of an electric turning gear for her sole gun turret. Her career was largely limited to coastal protection and as a summer season cruise ship for US Naval Academy midshipmen. Renamed OZARK in 1909, she served as a submarine tender during World War I. OZARK (ex-ARKANSAS) was decommissioned in 1919 and scrapped three years later.

Several other US Navy vessels were later given the name ARKANSAS, including CGN-41, the last nuclear-powered, guided missile cruiser built at NNS and completed in 1980.

Bill Lee
November 2013