Section 9. From Battleship to Armored Ship - a development revolution. The period 1864-1914

The cruiser corvette *Valkyrie* on its way out of the Port of Copenhagen, seen here in the white/yellow livery.
(Photo from Orlogsmuseet archive)

After the defeat in 1864, Danish defense policy entered a new phase. Technical development continued relentlessly and the era of wooden ships and sailing ships was over. The large ironclads took the place of the ships of the line, and new weapons and tactics were developed.
Denmark's territory had been severely curtailed and the German Confederation alias Prussia had moved dangerously close.

On land, the Danish army had been beaten by strong and technologically superior forces. But at sea the balance of power had been in Denmark's favour. German sea trade had been thoroughly disrupted by a blockade with Danish warships from Danzig in the east to Kiel in the west. And Danish warships could also have blocked the Elbe and Hamburg.
One of the navy's other tasks, to transport the army from Zealand and Funen to and from the theater of war in Jutland, the so-called Sea Transport Service, had also functioned as intended.
The navy's contribution to the land war, as assistance in the army's flank, had proceeded as well as it could in the narrow waters.

However, it had not succeeded in preventing the Prussians from pushing across Alssund. Which had its cause in the ships' slow reactions at night in the narrow strait in connection with the Prussians' greater strength and well-functioning coordination.
Cooperation between the army and navy leadership had taken place more smoothly than in the First Schleswig War. But there was still work to do with communication and clearer command structures.
However, the fleet had come out of the war largely without loss and with the sea skirmish at Heligoland on 9 May 1864 in proud memory.

The technical development here really took off after 1864. This was partly due to industrialization and partly to the American Civil War from 1861 – 1865, which has been called by many the first modern war. The navy followed - as well as the grants allowed - the rapid development of naval equipment.

The wooden ships were on their way out to be replaced by armored ships and ships built of steel.
The era of sailing ships was also definitively over, the coal-fired steam engine/steam turbine had taken over the role of sails.

During the long period of peace of almost 50 years, new weapons emerged that would come to characterize the next hundred years of naval warfare. The minesweepers, the torpedo boats, and not least the submarines and the aeroplane.

In 1866, the fleet left Gammelholm in inner Copenhagen, only the old forge, Holmen's church, remained. All activities, including the building of the fleet's ships, now took place on Nyholm and surrounding islets.

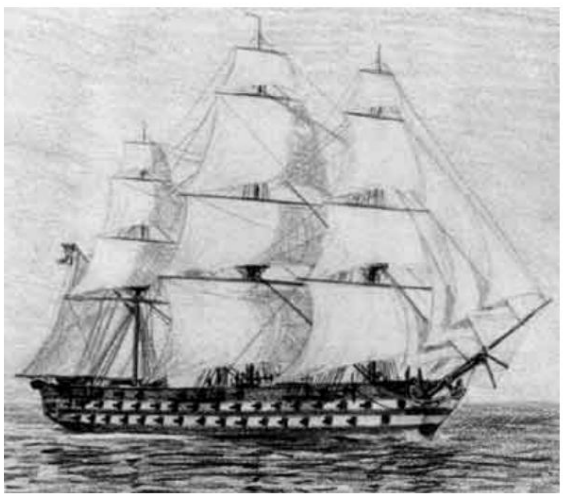
Technical development within warships continued at a high pace. But there were no decisive "sea wars" between the major powers. There was only talk of wars in the British colonies, Russia's battles against Turkey and the other southern neighbours, etc.

Armored battery *Rolf Krake* (Photo Orlogsmuseet's archive)

The ships that were modern in 1864 were the armored battery *Rolf Krake,* the armored schooners *Absalon* and *Esbern Snare.*

They were all three iron ships and purchased in England before the war. They were of a relatively modest size, which made them easy to maneuver in the shallow Danish waters.

The large still usable wooden ships that had built-in steam engines were the liner *Skjold* from 1833 and the frigate *Tordenskjold* from 1852,



The battleship *Skjold* (Photo from Orlogsmuseet archive)

The frigate *Tordenskjold* is seen here on Holmen after the conversion to a screw frigate in 1862.
(Photo from Orlogsmuseet archive)

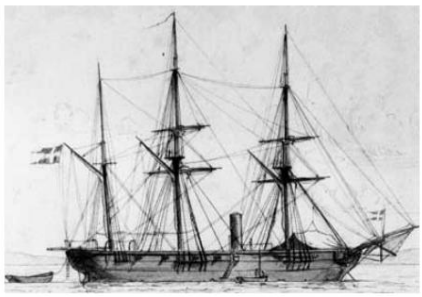
as well as the three steam frigates Niels Juel, Sjælland and Jylland built respectively 1855, -58 and -60,

Model of the Frigate *Jylland*

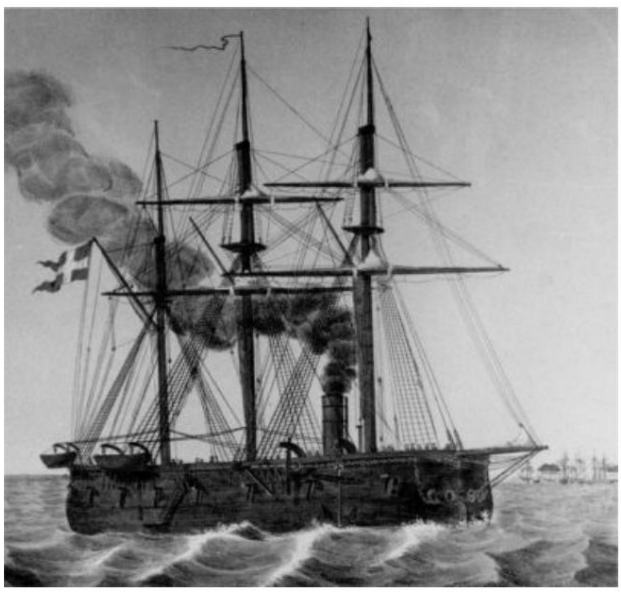
and the steam corvettes *Dagmar, Hejmdal* and *Thor* had all made great efforts in the blockade of German ports, by assisting the army and not least in the case of *Niels Juel, Jylland* and *Hejmdal* at Heligoland on 9 May 1864.

Dagmar 1861
(Photo from Orlogsmuseet archive)

Heimdal 1856
(Photo from Orlogsmuseet archive)



Thor 1861
(Photo from Orlogsmuseet archive)

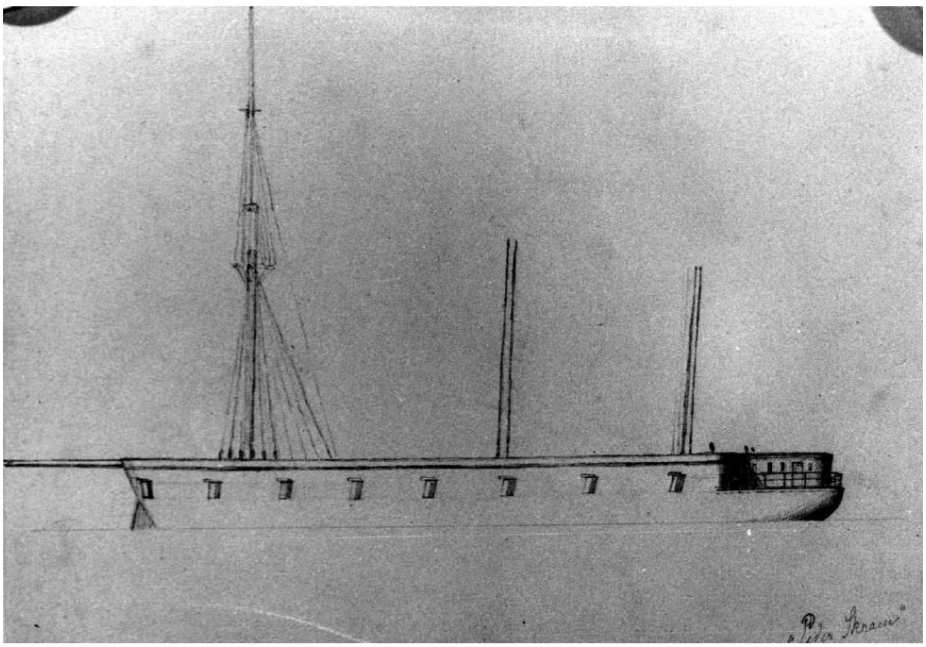


Also added was the armored corvette *Dannebrog,* originally the country's last large sailing ship of the line from 1850.

There in 1863 it had been converted into an armored corvette and had its original 84 guns cut down to 14 modern guns and had been fitted with a 400 hp steam engine.

Dannebrog as an armored frigate after the conversion 1862-64.
(Photo from Orlogsmuseet archive)

A similar transformation had occurred with the armored corvette *Peder Skram,* which was actually projected as the last steam frigate in a series of four, but which was changed to the armored corvette during construction and was launched in the autumn of 1864, which was too late for it to participate in the war.



The armored corvette *Peder Skram* (Photo from the National Museum's collections)

It was this relatively extensive fleet - literally in transition from sail to steam and from wood to iron - that was to be replaced in the coming decades by a fleet of steam-powered iron ships with and without armour. With far more effective artillery and other as yet unknown naval weapons, in a number and size appropriate to the performance of the country.

It thus became an important task to adapt the fleet's organization to the new age.
The changes naturally came first at Orlogsverftet, where the ships were built and maintained.

After eight years of political tug-of-war, in 1880 a new navy system was finally implemented.

This Act contained - in contrast to the Act of 1868 - a naval plan which stipulated that the Navy should consist of 12 larger and an appropriate number of smaller ships.

From the comments on the bill, it appeared that it was intended that the mentioned ship equipment should consist of:

8 armored batteries (armored ships), 4 larger unarmored ships, 10 corvettes, schooners and gunboats, 12 armored gunboats with armor-piercing guns - and 30 fast-moving torpedo boats.

Of these, there were in 1880 - in addition to the under construction *Tordenskjold* - the seven armored ships: *Heligoland, Odin, Gorm, Lindormen, Rolf Krake, Danmark* and *Peder Skram.*
The four larger unarmored units could include the cruiser corvette *St. Thomas* and, in case of need, *Ingolf* (with three 15 cm Baglade swing guns) and, for a short time, the screw frigates *Jylland* and *Sjælland.*

Corvettes etc. could include: *Dagmar, Hejmdal, Fylla* and *Diana* and the six steam gunboats from the 1870s. While the armored gunboats were only poorly represented by *Absalon* and *Esbern Snare,* which could no longer be said to have armor-piercing gunnery.
Of fairly fast-moving torpedo boats, there were only two of the 1st class, No. 4 and No. 5 – the later *Hajen* and *Søulven* (launched 1879-80).

When the law came into force, the larger units stipulated in the comments to the bill could thus be said to be present, by and large. The new building account, which had been deemed necessary to maintain and innovate the total naval strength stipulated in the law, was estimated at 7 million. DKK annually.

The navy was at the forefront of developments. Even though the grants were small, it succeeded in training technicians abroad, who were then partly able to manage a domestic production, partly able to teach a future generation. Within a very short span of years, technical developments led to the introduction of the following into a fleet which for centuries had relied on sails and cannons:

Wooden ships were replaced by iron ships, and they were gradually armored in the sides and on the deck as the ship's artillery became more powerful. In 1882, the navy received its first steel ship.

Old forward guns were replaced by breech-loading guns, which were rifled. Bullets were replaced by grenades, which were filled with gunpowder and later with more powerful explosives. The rifling led to greater precision, and new, powerful gunpowder types led to longer "range" (longer shot distances). From the small-caliber weapons, "machine gunners" were developed, i.e. fast-firing machine guns that could be used against nearby targets. Where guns had previously been mounted without the possibility of turning more than a few degrees, they were now mounted in swivel turrets. They were turned with the help of steam, electricity or hydraulics, and under the gun turrets there was an ammunition magazine with elevators that could lift shells and gunpowder charges up to the gun. With the introduction of electric searchlights in the 1880s, night combat at sea became a possibility.

After the Austrians' successful ramming of the Italian flagship *Re d'Italia* in 1866, "ram prows" were introduced on many warships - an invention that had been used in ancient Rome and since the galley fleets in the Mediterranean, among other things at the great naval battle at Lepanto in 1571 .

Diving also became a specialty that the navy had to deal with. From 1866 the fleet had so-called "heavy divers". They could work underwater - on the seabed or from a launched platform - wearing a suit with helmet and air hose.

Diving medicine and the investigation of diving accidents continue to be the responsibility of the navy.

Sea mines could now be laid as an effective barrier, and with the help of cables to a sea mine station on land, you could "switch on and off" a so-called "controlled minefield", for example laid out in navigable waters or off a harbor that needed to be protected.

At the same time, the torpedo had been developed as an effective weapon from smaller warships, which could now threaten even the largest units. If large ships were at anchor or in port, they protected themselves with torpedo nets along the sides.
The larger fleets equipped so-called *Torpedoboat Destroyers* (in German *Torpedoboot Zerstörer),* which were supposed to attack torpedo boats and keep them away from the larger units. Later they were simply called Destroyers (Zerstörer).

Around the turn of the century, the production of efficient submarines that could carry torpedoes began. Denmark got its first submarine *Dykkeren* in 1909.

At this time the ship's radio was also developed. Compared to the telegraph, it was a decisive improvement for both military and civilian shipping.

The first flight of a heavier-than-air aircraft took place in 1903, and in 1912 the Navy received its first aircraft named the *Glenten.* It was a gift from the aviation-interested Consul General Ludvigsen. The following year, the navy bought two more aircraft, which were named *Maagen* and *Ternen.*
The development in propulsion machinery was one of the most significant and quite revolutionary for all warship tactics. Now the wind played only a minor role. First came the steam engine, then the steam turbine and the marine diesel engine. Correspondingly, so-called "auxiliary engines" were developed, which supplied energy for the ships' internal operation - in addition to propulsion.
They supplied electric current or steam for winches, cranes, cannons, ammunition elevators, searchlights, etc

The technical development meant that the key word for the world's fleets now became education. In Denmark, the development meant that they now had to recruit gifted and robust men who could learn to operate all the new and complicated equipment. It required building an organization with barracks, school buildings and teaching staff. It was centered around the fleet's main base at Holmen and Orlogsværftet. Out in society, there came to be respect for the navy's training.

The naval non-commissioned officer school was started in 1867 in *Søkvesthuset.* Among approx. 200 annual applicants were normally assumed to be approx. 25 students. They were typically 14 to 16 years old, and after 6 and a half years they left the school as *Non-Commissioned Officers of II. Class.* It was a sought-after education, and then you could get a home in Nyboder (pronounced at the time as "Ny-bor").

The Navy's Officers' School.
Group photo of sea cadets. Approx. 1876.
(Photo from Orlogsmuseet archive)

Correspondingly, a technical organization had to be built which could select and test equipment types and be responsible for any equipment acquisitions at home and abroad. It was supposed to test equipment and be able to instruct the first crews. Finally, technical personnel were to be trained for service on board all the ships, who had to be able to operate relatively complicated equipment with mechanical and electrical components. In a time when these things had not yet spread to the population, but were only found in a few industries. *The Shipbuilding and* Mechanical School trained cadets for the *Machine Corps,* but from 1905 they were called *engineering students,* and after graduation they could call themselves *marine engineers.*

In this way, the Orlogsværftet, together with the navy's other authorities on Holmen, became: The institution in Denmark which dealt with the most modern technology in the period from 1864 to 1914. And it was here that Denmark's best engineers were employed. Here also started a collaboration between the navy and the nearby Burmeister & Wain, which developed into a modern shipyard and engine factory.

Enforcement of Danish neutrality

For the next several years, Danish foreign policy was based on keeping Denmark neutral, and the navy therefore had to be built up for defense tasks. As well as having such strength and composition that neutrality would be respected.

The situation around Europe was characterized by changing alliances and various wars around Europe.

Together with Sweden, Denmark had the opportunity to block the Øresund, and Denmark could block the Great Belt. And thus prevent the great powers from entering or leaving the Baltic Sea. Conversely, there was also the possibility of facilitating the passage through the Danish/Swedish straits.
Regardless of which model was chosen, however, it raised major questions about the possibility of maintaining neutrality in an eventual great power conflict.
Thus, e.g. considered the English in the 1890s a landing at Esbjerg or somewhere else on the west coast of Jutland or Schleswig-Holstein. With a view to destroying the Kiel Canal and opening a secondary front in the event of war with Germany.

One could then defend oneself, formally or to the best of one's ability, against any violation of sovereignty, but without certainty of the consequences. You also had to live with your neighbors after a war.
The Danish and Swedish neutrality policy was therefore largely based on the understanding of the great powers.

The development of the fleet

After the defeat in 1864, a change slowly but steadily began to take place with the Danish navy.
Wood and sail were replaced by iron and steam - the gunnery was moved from the ships of the line's fixed batteries below deck to rotatable towers above deck. Breech-loading cannons replaced the breech-loading cannons of earlier times, new weapons such as torpedoes, sea mines, submarines and aircraft were introduced. And quietly, ship by ship, a modern Danish fleet was formed.

Mines and torpedoes

A primitive form of sea mines had already been used at home during the war in 1864, and abroad people had gone so far as to have cable mines with gunpowder charge and electric ignition.

In Denmark, they now tried to find a Danish type of mine, but it was the army that took the first step by establishing a Naval Mine Department in 1866 under the engineer regiment, and in the same year the navy also acquired its first diving apparatus.

The torpedo boat *Springeren* (1891-1919) was the first Danish-built torpedo boat, in the background you can see the Søminestationen at Bramsnæsvig.
(Photo from Orlogsmuseet archive)

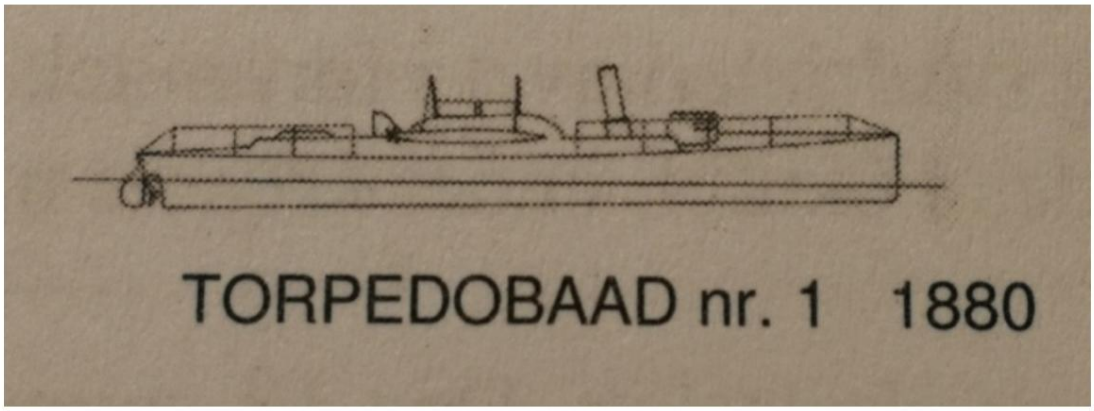
As early as 1 April 1878, the Naval Mine Service was established under the navy as an independent institution with responsibility for naval mines and torpedoes. Some of the country's most skilled technicians were employed here, so when in 1884 electric lighting had to be installed in the Royal Theatre, the installation was carried out by personnel from here.

In the first years, the launching of torpedoes took place from ships. Denmark obtained a license agreement so that they could produce torpedoes themselves at Holmen. In 1883, a sea mine station was established in Bramsnæsvig at the bottom of Holbæk fjord. This is where the torpedoes were to be inserted from now on before they could be used in the ships.

Bramsnæsvig Naval Station (Postcard origin unknown)

The first torpedoes had a speed of 20 knots and an explosive charge of 35 kg. Both speed and charge were gradually increased.

The development of the new weapons also gave birth to new ship types, the minesweepers, minesweepers and torpedo boats, and already on 17 September 1878 the first torpedo boat division was established, consisting of the steam sloops no. 1, 2 and 3, equipped with launch frames.



(from the National Museum's collections)

Later, actual torpedo boats, built in England, were added to the fleet, and in September 1890, the first Danish-built torpedo boat Springeren was launched from the Orlogsværftet in Copenhagen.

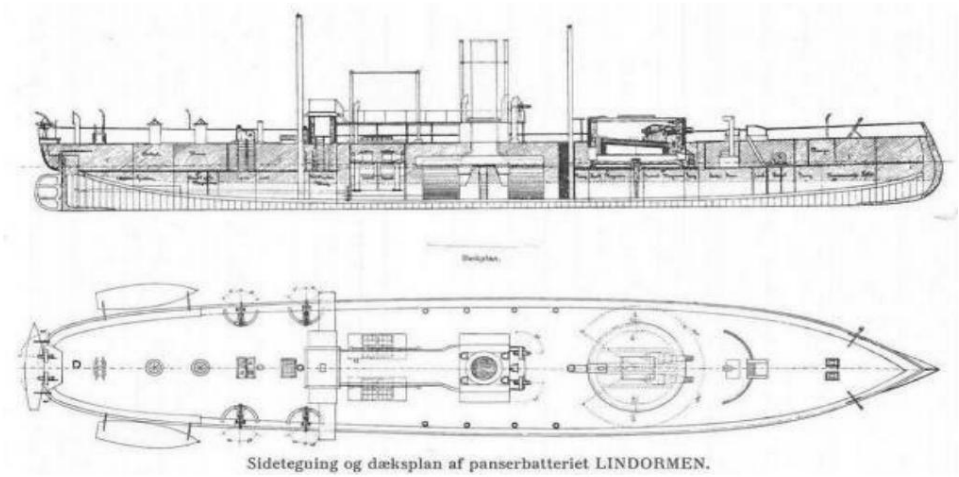
New buildings between 1864 and 1914

Technical development continued relentlessly. And the time of wooden ships and sailing ships was over. Nevertheless, not only in Denmark, but also around Europe, there were different perceptions of which ship types should be promoted.
The navy did not have the means to produce new ships in large numbers. But the fleet managed to keep up with technical developments all the time. Partly at Orlogsværftet and partly at the private shipyard Burmeister & Wain, with which the navy had excellent cooperation

The armored battery LINDORMEN

In the summer of 1864 - before *Peder Skram* was launched, and while they were still waiting for the new armored frigate to return from Scotland - the Orlogsværftet was busy with various projects for new armored ships.

In the Orlogsværftet's Archive you can see a draft for a battery ship with 8 15 cm guns.



Sideteguing og dæksplan af panserbatteriet LINDORMEN.

(Photo from Orlogsmuseet archive)

The drawing is from 1890 and thus does not show the "gunner's house". There were 6 watertight bulkheads from keel to deck: No generators and electric lighting. Heating of hatches, baths and other living spaces was done by tiled stoves. The command bridge was located on top of the command tower with bridge wings running completely outside the ship's side.

The Lindormen was quite a bit larger than the *Rolf Krake,* as the development gradually placed increased demands on both the artillery and the armor thickness as well as the speed. Waterline fairing that left the deck - approx. 0.93m above to 1.35m below the waterline, amidships was 127mm tapering to 1.15mm at the bows with 265mm of timber underlay and 19mm of iron inner lining. The gun turret had 140, the conning tower 127 and covered 25 mm of armor. The material was wrought iron.

The cannon tower stood approx. 2.2 m above the deck, and in everyday order its lower half, seen from the outside, was hidden by a fold-down salary. Above the deck, the tower - apart from the gun ports - was completely closed, so that there was only access to the tower from the tracks. Turning the tower could only be done by hand.
An actual ram was not found, but the bow, which was distinctly indented, was reinforced.
The reinforcement originally only consisted of the 2 pieces. 9” (22.89 cm - commonly referred to as 23 cm) Armstrongian wrought-iron breech-loading guns - in addition to some 4 pd. howitzers.

Actual secondary reinforcement was only added in 1875 with 2 pieces. 3" (76 mm front guns and 4 revolver guns. In 1879 the 3" front-loading guns were replaced with 2 87 mm breech-loading guns.
In 1881, however, the 2 additional 3” breech-loading guns remained, but these were replaced in 1886 with 87 mm breech-loading guns, of which there were now four. On various cruises, the *Lindormen* was equipped with towed torpedoes, which however proved to be highly impractical.
However, they did not come out of the regulations until 1888.

As a measure against a possible entry attempt, a so-called "shooting house" had therefore been built in Lindormen on the aft deck. The shooting house consisted of an iron tube closed at the top, which had room for the shooters and which was equipped with shooting shards for small arms. The shooting house could be shot up and down. It was intended that from here - even standing in cover - you should be able to coat the deck and refuse attempts to enter. However, this measure proved to be impractical and was therefore abolished when the ship was given secondary armour.

The Lindormen was our first 2-screw ship. The machinery consisted of two upright 4-cylinder high and low pressure engines of the tandem type, constructed by Wm. Wain and built by B. & W.
Range of action: 1400 nautical miles at 8.5 knots.

Like *Rolf Krake ,* the *Lindormen* was originally rigged with mainsails - a gaffed sail on each mast and two staysails fore. However, on the trial run, these sails proved to be more of a disadvantage than an advantage.
Why they were abolished already in the same year.

On the other hand, in 1873, the *Lindormen* got a wobble keel, which somewhat reduced the ship's movements at sea.

The armored battery GORM

Even before the *Lindormen* was laid down, projects for the next armored ship were in full swing: On 18 January 1866, a draft was available for a 78.5 m long rigged turret ship with two twin towers for 25 cm. guns and in 1867 to a casemate ship with 4 guns of the same size.
In addition, we now received drawings of monitors from Sweden, and in the spring of 1867 a draft was drawn up for a 2-tower monitor of 2800 tons and a somewhat smaller 2-tower.
However, they decided on a 1-tower armored battery, and 9 months before the *Lindormen* entered the water, the slightly larger and somewhat more powerful sister ship *Gorm* was laid down on 18 November 1867.

The armored battery *Gorm* laid out in the Navy's Leje 1903 (Photo from the Orlogsmuseet's archive)

The gun turret with the two 10” (25.4 cm) Abandoned guns could be moved by steam by hand as a reserve.

In the early 1880s, a 60 cm lens projector was installed on a pillar platform forward of the jibmast. Later, a 90 cm mirror projector was added between the mainmast and command tower.
Gorm got no ram, but reinforced bow.
As secondary reinforcement, 2 pieces were added in 1875. 3” (76 mm) Abandon guns, which in 1879 were supplemented by 2 pcs. 87 mm breech guns and 4 pcs. 37 mm revolver guns.
Like her predecessor, *Gorm* was for several years equipped with towed torpedoes until these were removed from the regulations in 1888.

In 1889, the two 3” (76 mm) breech guns were replaced by two 87 mm breech guns. However, this secondary armament of four 87 mm did not have a long life, as these guns were already replaced in 1891 with 4 pcs. 57 mm cartridge cannon as an anti-torpedo boat gun.
Around 1890, an open shunting bridge was set up in front of the chimney.

In May 1903, the two 10" (25.4 cm) abandoned guns were removed and replaced with 2 pcs. 15 cm Aft guns from the cruiser frigate *Fyen's* deck battery.
Unlike the *Lindormen,* which had two upright 4-cylinder high- and low-pressure engines from B&W., the *Gorm* got two horizontal 2-cylinder low-pressure engines from John Penn & Sons of Greenwich.
Range of action at 8.5 knots: 900 nautical miles - i.e. significantly less than in *Lindormen.*
Gorm was never provided with mainsails, but was already provided with a swinging keel during construction.

Interlude with gunboats

The Defense Commission, which had been set up after the 1864 war, submitted its report at the end of 1866, when Commandeurcapitain CE van Dockurn had become Minister of the Navy. However, the Riksdag did not finish processing the law until 1868.
Before then, in 1867, as a continuation of the armored ship construction after *Gorm ,* van Dockum had demanded a grant for a new armored ship, but when he had made this grant a cabinet issue and he did not succeed in getting the grant, he resigned and was succeeded by the former factory foreman and director Otto Suenson, who got the Navy Act passed.

The Navy Act of 1868, however, did not give the Navy peace and continuity in the newbuildings, as there was a lack of a fleet plan and a corresponding fixed newbuilding account.

Every time a new ship had to be built, it now gave rise to political discussions about the nature of the ship and disagreement about whether any new ship should be built at all. The unfortunate nature of this came to the fore particularly glaringly when, in September 1869, Suenson was replaced by the Minister of War, General Raasløff, as interim Minister of the Navy.
Raasløff broke the conditions for the new construction of the Navy's ships, which had been considered in the Defense Commission, as he was an opponent of larger ships and a supporter of armored and unarmored gunboats of very limited size, just as he wanted the Navy to be abolished as a department of the Army. He knew how to gain a hearing for his views in the government and therefore came into conflict with many of the navy's officers.

It was thus his mismanagement that we got the small steam gunboats with heavy artillery, just as he was responsible for the Panzerskibet *Odin* being significantly worse than originally planned - because the money had to be used for the gunboats.

In 1872, the gunboat built according to the Farcy system, the *Drogden,* was purchased in France, a 23 meter long iron boat of 50 tons with a ram bow and a powerful nine inch gun without protection.

Such a one had not previously been seen at these latitudes, and it quickly earned the nickname "the French clog".
With a 40 hp engine, it made a speed of seven knots and was very rarely used apart from the squadron exercises in 1876.

Then, in the years 1873 to 75, the Orlogsværftet built the gunboats *Falster* and *Møen ,* each approx. 390 tonnes and the somewhat smaller *Øresund, Great Belt* and *Little Belt* of approx. 240 tons.

These steam gunboats were armed with a heavy 10-inch gun and without armor protection.
They had a rough ride and were not spoken of favorably by the naval officers.

The big guns required a stable base, which the gunboats certainly could not perform.
At the slightest swell or sea, the shot went far over the target and made the gunboats unreliable.

Group portrait of the gunboat *Møen's* crew encircling the large 10" (25 cm) cannon ca. 1875.
(Photo from Orlogsmuseet archive)

In 1901, *Møen* was used for the navy's first trial shooting with high-explosive shells.
The tests took place in Øresund, but the cannon deposit caused the cannon to explode and the *Møen* was completely sunk. However, before the cannon was fired, the crew had been taken on board another vessel, which is why the accident did not cause any injuries.

The two large *Falster* and *Møen* originally had a 10" (25 cm) gun with 18 tons weight on the foredeck and the speed was a modest 9.8 knots.
The smaller types, *Øresund, Storebælt* and *Lillebælt ,* were also equipped with a 10" (25 cm) cannon and could achieve a speed of 7.4 knots.

The ships mostly came to function in connection with Copenhagen's sea fortification, but were not a success in their original form. You could say that the five gunboats were an interlude, following guidelines given by politicians. Several of them, however, had an astonishingly long life and were only phased out after the First World War after serving for a long time as auxiliary ships in completely different functions.

The construction of new armored ships (the monitors) continued, and in 1880 the armored ship *Tordenskjold* was launched from the Orlogsværftet , which with its 14 inch (35 cm) cannon was for many years the most heavily armed armored ship in the Nordics. The ship was also the first Danish warship built primarily of steel.

The armored ship *Tordenskjold,* launched in 1880, was not only the fleet's first ship built primarily of steel, but was for many years the most heavily armed armored ship in the Nordics with its 35 cm cannon. (Photo from Orlogsmuseet archive)

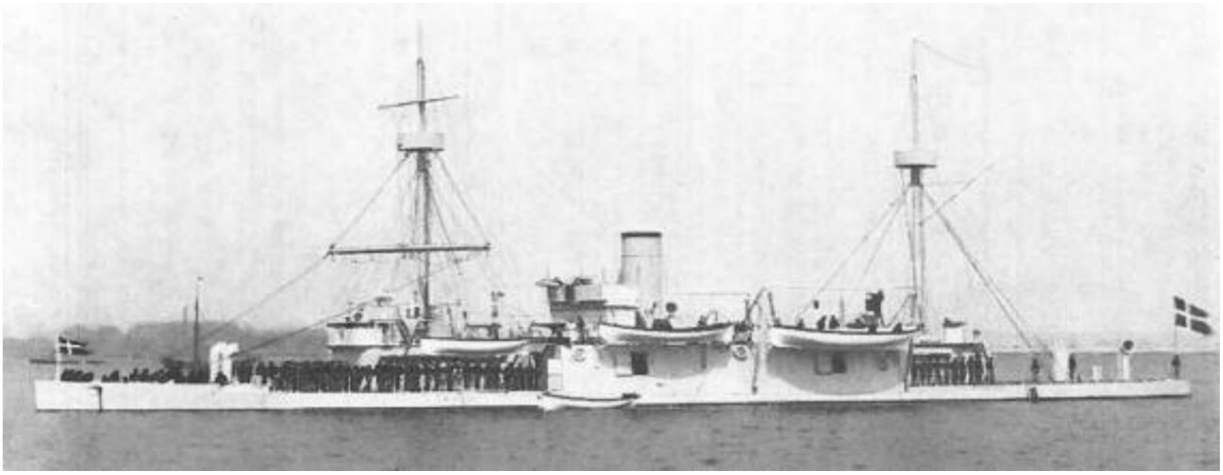
However, some still believed in the sailing ships, and on 27 September 1882, the fleet's last large ship with sail rigging, the cruiser frigate *Fyen, was* launched. As a warship, the *Fyen* only had a short career, but functioned as a barracks ship at Holmen right up until 1962.

Cruiser frigate *Fyen* (Photo from Orlogsmuseet archive)

The battleship ODIN

The costs of the gunboats came to influence the new large ship *Odin,* which was launched at the end of 1872. The ship had an armour-protected, covered casemate, in which four pieces were placed. heavy 25.4 cm rifled cannon of Armstrong design, one in each corner.
The ship's side armor also covered the casemate amidships with a thickness of 203 mm, tapering along the sides to 127 mm at the bows.

The guns' rate of fire was one shot every six minutes, and they could reach 4,500 m. The ship's engine produced 12 knots and they had now again had the engine built by Burmeister & Wain, but this time with two horizontal high- and low-pressure engines of the tandem type. The size of the crew was initially set at 250 men.



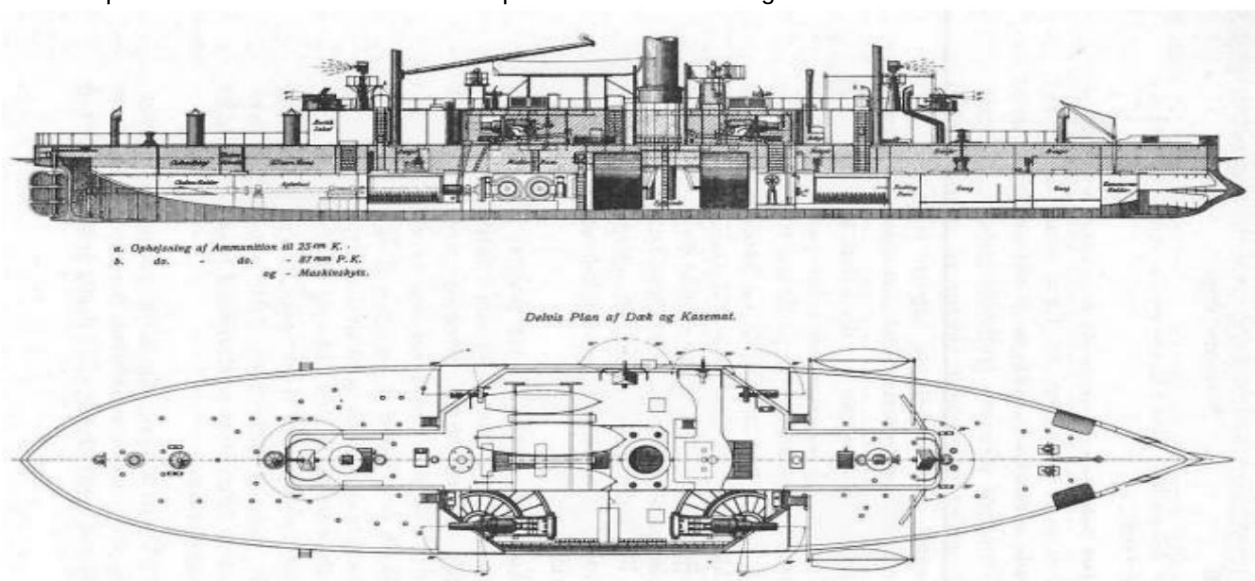
The armored ship *Odin* 1885 in color 2 with the 87 mm breech guns without shields placed on the casemate roof above the corners of the casemate (Photo from Orlogsmuseet archive)

Odin was also equipped with a spur to bump up into the opponent's "soft" underwater body and create a rapid leak if the opportunity arose. The spur was a round iron cylinder built into the bow below the waterline, which could be pulled into the ship while underway and pushed forward when in use. This device was replaced in 1892 with a fixed ram bow, which should be able to cause major damage if necessary.

However, as the years passed and development progressed, the difference in combat value between the old *Odin* and the newer armored ships added in the meantime became more and more glaring. And when *Odin* reached the age of 25 in 1897, the difference between this ship and the new armored battery *Skjold* - not to mention the *Herluf Trolle* that had just begun - was so great that they seriously considered decommissioning the old ship.

An international wave of revitalization of older armored ships swept over the maritime nations in this period and *Odin* became the Danish example.

The trend towards facelifts of older armored ships, which as already mentioned had come into vogue abroad in these years, now also won supporters here at home, where then - as so often later - it was easier to get money for the repair and modernization of older ships than for new buildings.



Side drawing and deck plans (1900) of the armored ship *Odin* after the various conversions with 4 pcs. 25 cm Backload guns in the bevelled corners of the casemate. (Photo from Orlogsmuseet archive)

Despite the years, there was nothing wrong with *Odin's* machinery, and the speed - 12 knots - was not too far from *Skjold* 's 13.4 knots and the sailing speeds of most other somewhat older armored ships

With regard to the artillery, however, it was worse. In any case, the old cannons had to either be replaced with breech loaders. The old abandoned artillery was replaced with 25.4 cm breech-loading guns in rebuilt embrasures. The breech loading meant that the rate of fire could be increased to one shot every two minutes per cannon.

The restricted shooting freedom with blind spots also had to be improved - e.g. by a reduction of the casemate corners, whereby the guns got an unbroken coating angle, so that the port change was avoided, similar to what was the case with the casemate guns in *Heligoland.*

A 60 cm mirror projector was installed on this occasion, while ordinary electric lighting was not considered necessary. The decommissioned ship was not reclassified to a defense ship until after 1909 and retired from the fleet in 1912 after 40 years of good service.

The worst part was the hood. The old wrought iron armor had now long since been distanced partly by the modern artillery and partly by the new armor materials. Thus, only minor improvements were possible in the area of the hood.

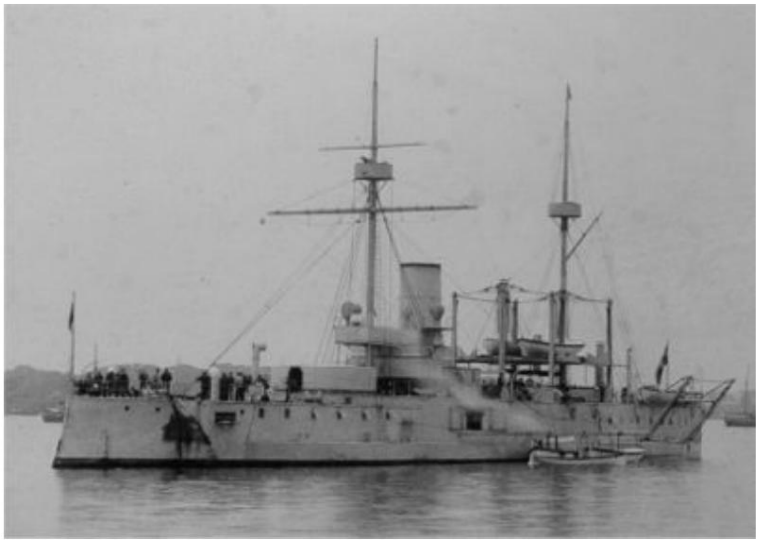
Nevertheless, in the years 1898-99 a thorough modernization was carried out along the main lines mentioned.

The armored ship HELGOLAND

Six years would pass with the intervening period of gunboat construction before the next armored ship was laid off at Orlogsværftet. It became *Heligoland,* which represented a larger ship type with unprecedentedly powerful artillery. Marine Minister NF Ravn had managed, despite a time with limited funds, to complete the new armored ship project, which was started in 1876 and launched in 1878.

The armored ship *Helgoland ,* however, became Denmark's largest warship to date with a displacement of 5,480 tons and an engine power of 4,000 hp, which gave the ship an unprecedented speed of 13.7 knots. The size of the crew was a considerable 350 men.

The hull was protected by a very strong armor purchased in France. Side armor was 203 mm amidships and reduced to 157 mm at the bows. It extended 1 m above the waterline and 1.25 m below. Four 26 cm guns were protected in a casemate as on *Gorm,* but at the front the casemate was connected to a barbette turret containing the heavy 30.5 cm gun. All guns were cast steel breech-loading guns from Krupp. The large cannon's firing distance was 6400 m and the firing rate was approx. five minutes between shots. The cannon could be swung around by hand by eight men at the cranks.



The armored ship *Heligoland.*
(Photo from Orlogsmuseet archive)

The casemate had a 26 cm gun in each corner, arranged in such a way that it was possible to turn the gun for firing from longitudinal to 105 degrees transverse. From the beginning, *Heligoland* was also equipped with five units. 12 cm breech-loading guns. But as on all ships, the armament was gradually adapted to the practical conditions and the number of 12 cm guns was reduced.

Heligoland was also the Navy's first combat unit to be armed with Whitehead's self-propelled torpedoes. Admittedly, the armored *schooner Esbern Snare* already had a fixed 38 cm bow torpedo apparatus installed in 1876-77 during the conversion to a torpedo ship. But in part *Esbern Snare* had thereby become a test and practice ship. And in part, a provision had already been made before then regarding Heligoland's torpedo armament.
In 1888, two more launchers for 35.5 cm torpedoes were added for installation in the officers' mess during clear-ship manoeuvres.

Our first torpedo boat with self-propelled torpedoes was only launched a year after *Heligoland* – in 1879. When designing the ship, the plan was to carry two small torpedo boats, which were to be placed aft of the chimney. The arrangement was dominated by four outrigger booms that were folded up in a vertical position when the ship was underway which was common in the infancy of the torpedo weapon.
On the large ships, small steam-powered torpedo boats could be taken, which could be put into the lake when you had come so close to a possible one. enemy that the small fast boats could surprisingly reach attacking distance. The fact that the armored ship's vulnerability to nighttime attacks by enemy torpedo boats was great, was practiced here in the opposite direction.
A parallel to this was when the English in 1807-14, after a few years of Danish gunboat attacks on English warships and convoys, considered the business of the gunboats so useful that they themselves began to bring along gunboats to counter the Danish ones.

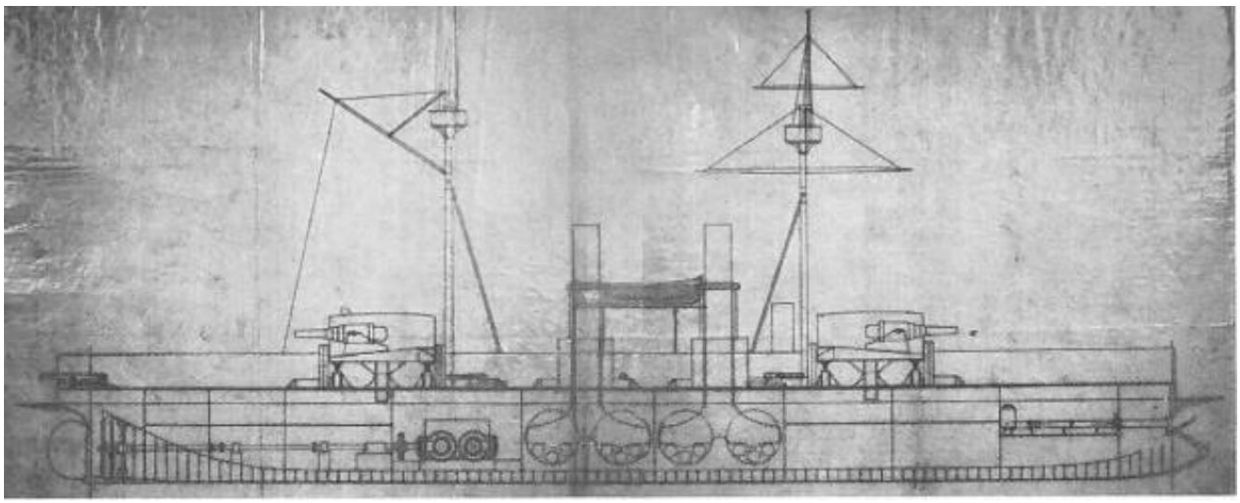
From the beginning, the ship was equipped with mirror projectors, an aid for lighting and thus combating nighttime torpedo boat attacks, and the ship was also considered worthy of having electric lighting installed in 1882. Heating of indoor facilities was done with steam in the officers' quarters and tiled stoves in other rooms.

The armored ship TORDENSKJOLD

While the *Heligoland* was still on the docket, the Navy dreamed of another new ship of the same size, and in 1877 the Orlogsværftet's Konstruktionskontor prepared a draft for such a ship with 4 pieces. 30.5 cm breech guns in two double barbette turrets and 6 pcs. 12 cm breech guns and 2 pcs. torpedo devices.

But the political wind was not blowing from any favorable corner for large ships. All that the Marine Ministry had dared to include in the budget proposal for 1878-79 was therefore an armored gunboat.

However, the political negotiations on this ended with a sum of approx. 2 million DKK, for which money a ship had to be built with a 14" (35 cm) gun and torpedo apparatus, leaving it up to the designers to get as much as possible out of the armor within the given financial framework.



Side drawing for an armored ship project from 1877 with 4 pcs. 30.5 cm breech guns in two double barbette turrets and 6 pcs. 12 cm Aft guns and fixed underwater torpedo apparatus in the bow (above the ram) and a torpedo gun aft. (Photo from Orlogsmuseet archive)

It was thus a highly constrained task that could only find an acceptable solution by completely sacrificing the vertical armor of the ship itself. And settled for an armored deck in connection with an extensive waterproof division using cork-filled cells along the waterline. In reality, it meant a continuation of the gunboat idea - only with a thoroughly oversized gunboat as a result.

They therefore also initially refrained from classifying the ship as an armored ship and chose the somewhat strange type designation torpedo ship - not only because of the torpedo armour. but also because the ship was destined from the beginning to carry two small 2nd class torpedo boats. Armed with the Fleet's heaviest gun, as the ship was, artillery ship would probably have been a more appropriate designation. But the torpedoes, with the self-propelled Whiteheads, were really breaking out in those days - and there was therefore more effect in a type designation that included the word torpedo.

When the new classification was introduced in 1885, *Tordenskjold* was included as an armored ship.

Tordenskjold was - as the first ship in the Fleet - built of steel, although iron was used in some places, e.g. for the ram race and the clothing under the water, etc

While the deck armor in the earlier armored ships had been flat and horizontal and resting on the upper edge of the side armour, here a vaulted armored deck was used, going from bow to bow and shaped like an angular turtle shield, the upper flat part of the center ship lying 50 cm above the waterline of the drawing, while the lower part out in boards abutted the ship's side 110 cm below the waterline.

As mentioned, the ship's side itself was completely unprotected in the waterline. To ensure buoyancy in the event of damage to the ship below the armored deck, the space below this was divided into 30 watertight compartments, just as - for the first time in our armored ships - there was a double bottom under machinery and boilers.

In order to prevent the water from a leak in the ship's side from spreading into boards in the space above the armored deck, a 5 mm thick waterproof and horizontal deck was laid out from its middle horizontal plate to the ship's side along the entire length of the ship.

A wedge-shaped space was thus created between this deck and the underlying armored deck, which was divided on each side by waterproof shutters into 37 cells, which were filled up with impregnated cork. If the side of the ship were to be pierced by a shot, this would prevent larger masses of water from penetrating and affecting the stability.

However, this method turned out to be less appropriate - on the one hand the cork was flammable, and on the other hand it had a not inconsiderable weight, just as it only partially filled the watertight closed cells.
The method was therefore not later used at home with cork as filling material.

The armored ship *Tordenskjold* 1884 in color 2 with the two 2nd class torpedo boats on board - No. 4 on the port side and No. 5 on starboard. The difficult rough between the chimneys was used for launching and launching the torpedo boats.
(Photo from Orlogsmuseet archive)

The command tower was located above the narrow aft part of the barbette tower, so that machine telegraphs and control cables etc. went down through this. Between the conning tower and the barbette, the wires etc. passed through an armored tube.
The command tower was originally only protected by 31 mm steel plates, but was given 152 mm armor in 1890.

The barbette tower stood directly on the armored deck. Its 203 mm thick armor had 15 cm of teak underlay as well as two 7 mm steel plates as an inner skin. In the tower stood the 35.5 cm Krupp breech-loading guns. As mentioned, it was the Navy's - and the Nordics' - heaviest breech-loading cannon, with a range of approx. 9,000 m and a lateral freedom of 135° from the diametral plane. A 40 mm steel screen in the shape of a ball cap was placed above the cannon and the gunwale.

The rate of fire was one shot every 10 minutes, but then the shot also went off with a bang that shook the whole ship. With its length of 8.9 m, the gun quickly earned the nickname Long Tom, which it retained, although *Iver Hvitfeldt's* two 26 cm Baglade guns surpassed it six years later with their 9.1 m.

The lateral direction and ammunition hoisting was done by hydraulics, whereby the operating crew could be reduced to 16 men compared to the 19 men for *Heligoland* 's 30.5 cm cannon.
When lifting the ammunition, however, it was necessary for the cannon to be exactly longitudinal so that the elevator could correspond with an opening in the tower floor. Hoisting took 22 seconds from the artillery tracks to the rear of the gun.

All the way back were the 4 pcs. 12 cm breech guns, which were also of Krupp's make. Originally these guns were completely unprotected, but following the rapid development of the light, fast-firing machine gun in the 1880s, in 1889 they were fitted with semi-circular steel shields attached to the slide. The rate of fire was one shot every two minutes and the ammunition supply 100 rounds per minute. cannon.

In the bow under the ram was built a 38 cm bow device for air launch, while aft under the four 12 cm was a 35.5 cm surface torpedo battery - originally consisting of two transom drop devices and aft a torpedo gun, all of which fired through ports. In 1890, the two landing devices were replaced with torpedo guns, at the same time as the hitherto completely unprotected sides of the ship next to the torpedo battery were covered with 25 mm steel plates.

Tordenskjold was destined to be equipped with the two 2nd class torpedo boats No. 4 and No. 5 (launched 1882), which was raised and lowered using a hydraulic hoist.
The torpedo boats were allowed on the voyages in 1883 and 1884.126 In 1888, however, it was decided that the boats should no longer belong to the ship. In return, the weight thus saved was utilized for the installation of Bullivan's torpedo net.

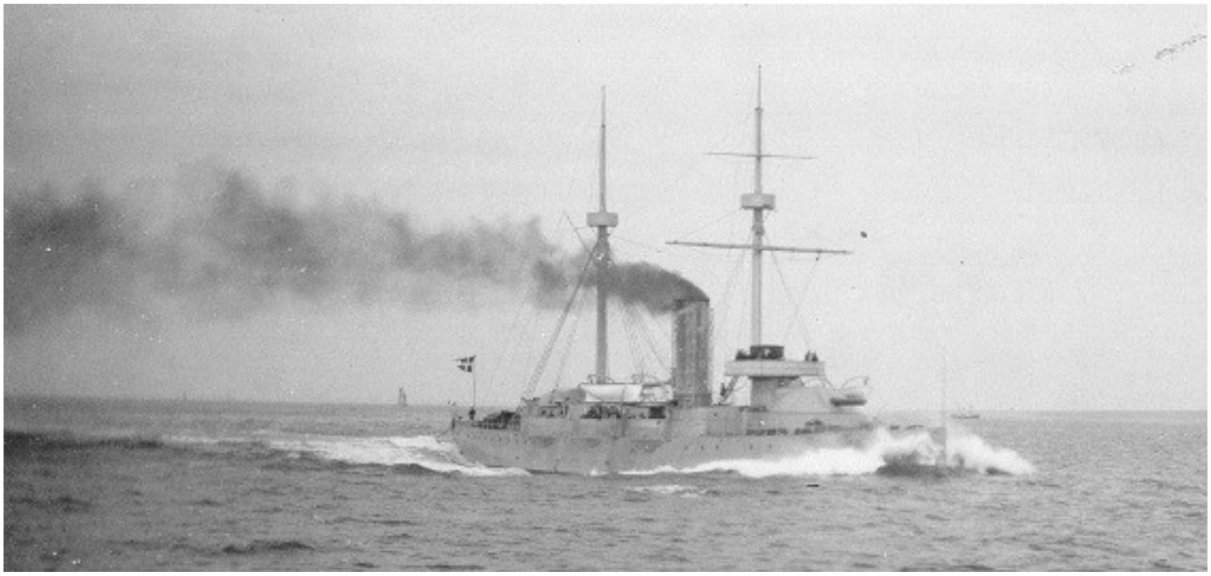
Tordenskjold was the first ironclad to have fully inboard electric lighting installed from the start. There were two 60 cm mirror projectors - originally placed on pillar platforms in tables a little aft of the aft chimney. Before the ship's last voyage (1901) they were moved with their platforms - one up on the bridge and - the other aft at the 12 cm battery. There were still only tiled stoves for heating the ship's various rooms.

Machinery and boilers were built by Burmeister & Wain. Range of action: 1,500 nautical miles at 9 knots.

The armored ship IVER HVITFELDT

Shortly after the adoption of the Swedish Navy Act, the Orlogsværftet thus prepared the drawings for a ship with vertical armor and 2 pieces in 1880. 35.5 cm in individual barbette towers fore and aft and 6 pcs. 15 cm in a casemate. Later, the initial preparations for the realization of a similar project had progressed so far that in 1881 plans were obtained from the English company Brotherhood for transom underwater torpedo devices.

However, none of these projects were realized. Instead, as we know, we got the herring feed, the cruiser frigate *Fyen ,* whose construction was trumped by Marine Minister Ravn. It must be said that it was his biggest mistake in terms of new building to sacrifice - 2,765,000 DKK - a not small sum by the conditions of the time - on an admittedly stately, but at this time less valuable ship as a combat unit.



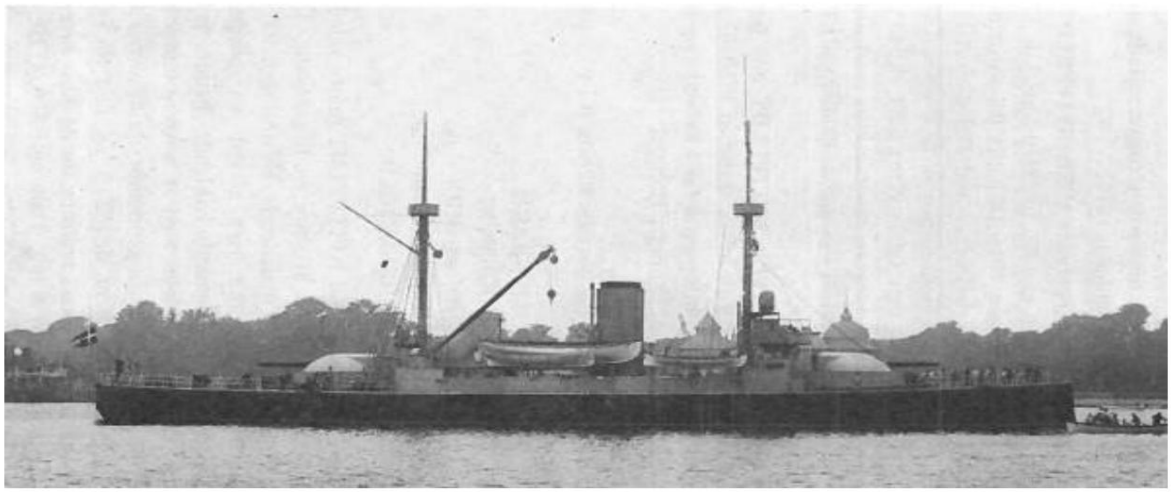
The armored ship *Iver Hvitfeldt* during speed trials 1887 (color 2). The *Iver Hvitfeldt* is the only one of our later armored ships that has had a jump (Photo from Orlogsmuseet's archive)

Just as *Tordenskjold* could be said to have a foreign model, the new ship, which was designed by Orlogsværftets Konstruktionskontor and which was keeled in 1884, was also inspired by what was new in foreign armored ship construction at the time. The new building was named *Iver Hvitfeldt.*

The battle between the artillery and the armor had resulted in heavier and heavier armor - and thus a greater armor weight. With wrought iron, which was still the most common armor material in the 1870s, you gradually had to go up to a thickness of 600 mm to be able to reliably guarantee against penetration by the hardest projectiles of the time. With such an armor thickness along the entire waterline, a ship could not float if the artillery and speed factors etc. also had to be taken into account. But even with a better armor material - compound armor or steel - the armor weight would be far too great with such extensive effective armour.

Based on the basic rule that whoever wants to protect everything protects nothing, they therefore gave up on armoring the entire waterline and concentrated instead on protecting the ship's vital middle section with the necessary armor thickness.

It was enough to give the fore and aft ship a vaulted armored deck below the waterline and a complete watertight cell division. that it was certain that as long as the armored midship's citadel was undamaged, the ship would be able to stay afloat, even if the unarmored ship's side in the fore and aft ship was breached in several places.



The armored ship *Iver Hvitfeldt* 1904 (colour 4) with radio pole on the foredeck and 90 cm searchlights.
(Photo from Orlogsmuseet archive)

The two Krupp 26 cm Baglade guns stood as a bow and stern source, each in a high barbette tower on the armored deck. The towers were circular with a pear-shaped extension towards the middle of the nave.

The cannon operation - both the turning of the system and the ammunition hoisting took place by hand.
With 8 men at the turnstiles, a 90 ÿs turn could be completed in 40 seconds.
The cannons had a maximum range of 9,500 m and a rate of fire of one shot every 4 minutes.

On board there were four torpedo devices - a 38 cm underwater with air launch located in the bow under the ram. Three overwaters on ball joints (torpedo guns with air or gunpowder launch), of which one 38 cm aft in the officer's mess and two 35.5 cm in boards in the broad sides of the banjer deck slightly forward of the chimney

The machinery, built by Burmeister & Wain, consisted of two sets of recumbent high and low pressure machines, receiving steam from eight low cylindrical artificial draft boilers arranged in four rooms.
Central heating and interior electric lighting were installed from the start.
Range of action was 1,600 nautical miles at 9 knots

The two 2nd class torpedo boats No. 8 and No. 9, built by Thornycroft in 1886 to take the *Iver Hvitfeldt,* was brought in and out with steam winches and a heavy vessel's boom, and in 1890 Bullivan's torpedo net was installed

The armored ship *Iver Hvitfeldt* 1890 (colour 2) with the torpedo net and the two 2nd class torpedo boats No. 8 on the port side and No. 9 on starboard. (Photo from Orlogsmuseet archive)

The cruiser VALKYRIE

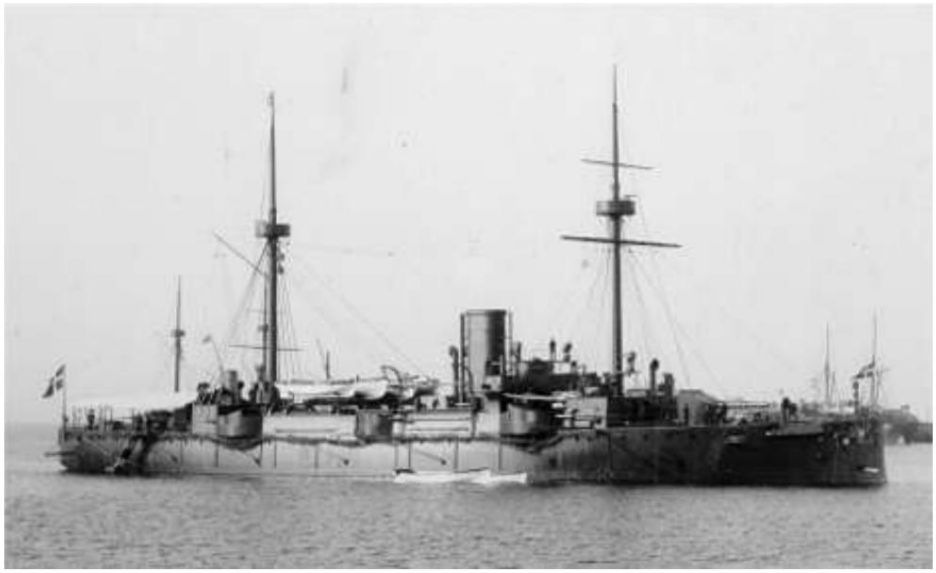
After *Iver Hvitfeldt's* launch, several years passed before a new armored ship was built, but in these years significant technical innovations took place. In maritime engineering, they began to dispose differently with regard to armour. As this part of the ship's protection easily forced the size of the ships into the air, when you also had to take into account the weight of the heavy guns and the powerful machinery needed to provide the necessary speed.

At the same time, the artillery was undergoing a rapid streamlining, where, among other things, had developed a greater ability to penetrate the armor. Other lines were thought of, partly as seen in the construction of *Tordenskjold* and *Iver Hvitfeldt* with a vaulted armored deck and both transom and longitudinal waterproof cells in the hull.
Without the heavy armour, you could increase both the weight of the cannon and the strength of the machinery and thus the speed, so that you could surprisingly quickly engage the heavily armored enemy with large, slow-firing cannons.

The cruiser *Valkyrie* on its way out of the Port of Copenhagen, seen here in the white (hull)/yellow paint (superstructure) (Photo from Orlogsmuseet archive)

In 1884, a fast cruiser was launched at the English shipyard Armstrong in Elswick, which did not have vertical armour, but armored decks and fast-firing 15 cm guns and new high-explosive shells. It was this cruiser that provided inspiration for the future cruiser types that were built by the maritime nations, i.a. in Denmark where the *Valkyrie* was launched from Orlogsværftet in 1888.

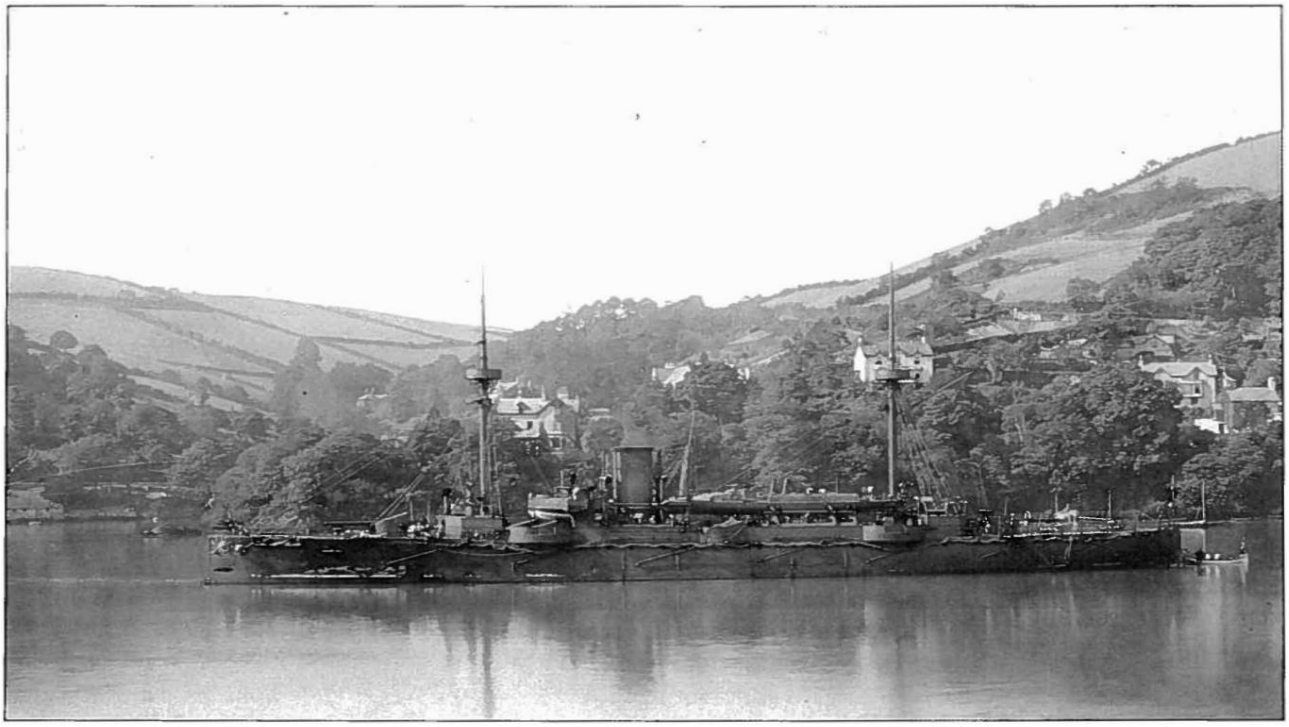
The drawings for the ship were made at Orlogsværftet's design office



The cruiser *Valkyrie.* (Photo from Orlogsmuseet archive)

The ship was equipped with a vaulted armored deck like the previous large ships, as well as a cell system with longitudinal and transverse frames, double bottom under the engine room and the magazines.
The machine was again from Burmeister & Wain with two high and low pressure machines. *The Valkyrie* had a displacement of 3020 tons and an engine power of 5300 IHK, which gave a considerable speed of 17.5 knots. The ship had a radius of action of 3900 nautical miles at a speed of 10 knots.

As in *Iver Hvitfeldt ,* two small torpedo boats were also included, but they were only in use for a year before they were replaced with smaller steam barges.



The cruiser *Valkyrie,* launched 1888. The ship is seen here in its original appearance with two small torpedo boats on the deck behind the chimney, unanchored off the English coast. (War Museum)

After the Valkyrie, the armored ships were pushed aside and, following a proposal from the government - i.e. Marine Minister Ravn - the Marine Ministry decided that, in the future, ships with modern facilities that suited the times would be built to replace the older units that sailed inspection service

Thus, the significantly smaller units *Hekla* (1890) and *Gejser* (1892) were launched. and *Hejmdal* (1894), each of approx. 1300 tons displacement, with engine power of 3000 hp, which could produce 17 knots and with crews of approx. 150 men.

The cruiser *Hekla* here in gray paint. (Photo from Orlogsmuseet archive)

The capacity was thus increased considerably with the new ships, not least with regard to the speed, which was only 10 knots with the old inspection ships. An epoch-making aspect of the navy's shipbuilding was that the three new ships were built according to almost identical drawings. Thus, a number of advantages were achieved in terms of equipment, spare parts, etc.

During the previous 30 years, each ship had been built individually and all the innovations that appeared over time had been introduced, with the result that there were individual conditions to take into account almost everywhere.

The cruiser *Geyser (Photo from Orlogsmuseet archive)*

The new cruisers were protected by armored decks with varying thicknesses of up to 45 mm and had a ram bow with an overhead torpedo launcher. On the upper deck were two pcs. 38 cm torpedo guns for transom launch.
The reinforcement on *Hekla* consisted of two pieces. 15 cm breech-loading guns protected by semi-cylindrical shields with a range of 8000 m.
However, the front cannon was not mounted on expeditions to the North Atlantic to lighten the foreship during the journey up the lake.
Geyser and *Hejmdal* each had two units. 12 cm cartridge guns. The ships were equipped with two masts for signals and after 1900 also got tall radio masts.
The cruisers *Hekla, Gejser* and *Hejmdal* replaced each other over the years as inspection ships at Iceland and the Faroe Islands with complementary functions as training ships in Danish waters.

The cruiser *Hejmdal* on its way out of the port of Copenhagen. (Photo from Orlogsmuseet archive)

After 20 years of grueling service in the North Atlantic, *Hekla* was transferred to the reserve, but had a renewed function in 1914, when it was equipped as a depot ship for the submarines and the following year also as a logic ship for flying boat operators.

The cruiser *Geyser* had a more modern artillery installed from the beginning with cartridge guns and unit cartridges. Trial firings were carried out with fast-firing 12 cm guns of Krupp's make with five shots per shot. minute.

The Hekla had originally had 15 cm breech-loading guns with a rate of fire of one shot per second. minute.
Even the range of *Geyser's gun* was thus greater, namely 9400 m against *Hekla's* 8000 m.
The machinery, like for *Hekla ,* was two upright three-stroke machines from Burmeister & Wain.

In contrast to *Hekla , Gejser* was also engaged in squadron service in home waters over the years and after 1910 functioned as the mother ship for the torpedo and submarine boats.
In August 1914, *Gejser* was fitted out again and was part of the security force until 1918, after which it was a training ship for the constable school in 1919 with a subsequent tour in the northern waters.

The cruiser *Hejmdal,* the last of the cruiser series, had largely the same course of service as the other two, with long periods of station and fishery inspection as well as sea surveying, although interrupted by winter voyages to the Mediterranean in 1897 and 1903.

The armored battery SHIELD

As the last of the individually built armored ships, *Skjold* was launched in 1896 after several years of political opposition, where the government, on the recommendation of the Ministry of the Navy, had proposed a new armored ship of 3500 tons to renew the older artillery ships.

Since the government could not obtain the necessary grants for a regular armored ship, the solution was sought in a smaller ship of the armored gunboat type. Orlogsverftet then prepared drawings for the armored battery *Skjold,* which was launched in 1895, but only took command in 1897.
Skjold was no technical marvel, but with its solid quality it nevertheless came to fulfill the role of an armored ship. The displacement was 2195 tons and the machine developed 2400 IHK, which gave a speed of 13-14 knots. The reinforcement was relatively modest and consisted of one piece. 24 cm breech-loading Krupp-made cannon standing in a turret on the foredeck and three pcs. 12 cm fast-firing Krupp guns as secondary artillery on the aft deck.

The armored battery *Skjold* was launched in 1896. It was considerably smaller than the other armored ships. With a crew of only 137 men, it did very well among the larger ships. (Photo from Orlogsmuseet archive)

After a 25-year tradition of constructions with box mats and barbette turrets, it was now back to revolving turrets such as the armored batteries *Lindormen* and *Gorm* with low freeboards and armor from bow to
rally.

The shield was also fitted with a ram below the waterline. But unlike the other armored ships, it did not carry torpedoes.
It only had a modest crew of 138 men who, right from the start, had the pleasure of electric lighting and heating of the hatches with steam in pipelines.
The ship's hull itself was built in a modern way with longitudinal and transverse frames and a cell system, as well as a double bottom under the vital parts such as the machinery, boiler rooms and powder magazines.

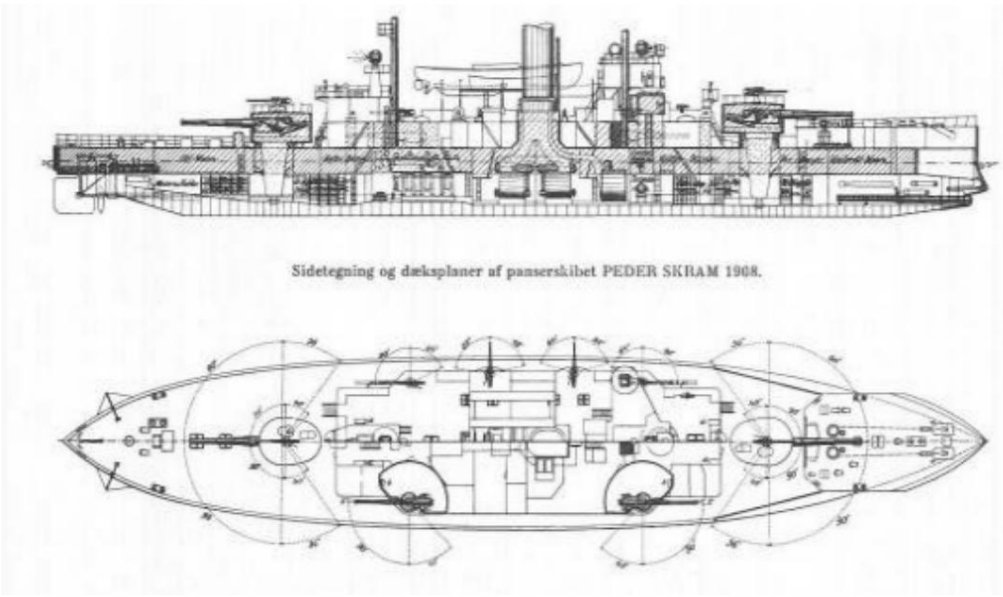
If one could speak of a modernity in *Skjold ,* it was the powerful 24 cm cannon on the foredeck, which had a far greater barrel length than the cannons of the old armored batteries. With the new slow-burning gunpowder, *Skjold's* cannon could achieve a greater penetrating ability than Iver *Huitfeldt* 's 26 cm cannon.

It reached a range of 9800 meters and a rate of one shot every two minutes.
The smaller 12 cm rapid-firing guns had a range of 7,300 meters and a rate of five rounds per minute. Skjold's artillery was therefore completely modern and contemporary in terms of size.

The armored battery *Skjolds* was built with the specific purpose of participating in the defense of Copenhagen's sea fortifications, although the ship also took part in squadron exercises and took part in voyages abroad such as Norway, Sweden and Russia before the First World War.

The last large ships before the First World War

At the beginning of the new century, funds were obtained to build three powerful armored ships of approx. 3,600 tons. It was *Olfert Fischer (1903), Peder Skram (1908)* and *Herluf Trolle (1909)* who were included in the fleet's numbers between 1903 and 1909.



Coastal defense ship *Peder Skram* (Drawing from Orlogsmuseet archive)

They were later referred to as coastal defense ships. The idea with them was that they should be able to cover the straits with their powerful artillery armament with 24-cm. guns.
The ships should also be able to participate in the defense of the capital in cooperation with the forts. They had to be heavily armored and have a relatively small draft, so that they could pass through the Danish part of the Sound at Drogden.

Speed had not been given that much importance, so their maximum speed was therefore only 15 – 16 knots.

The armored ship HERLUF TROLLE.

On September 2, 1899, *Herluf Trolle* was launched with the usual ceremonial display of our larger ships' stack discharge and in the presence of the Royal Family and various military and civilian dignitaries.

In terms of shipbuilding, *Herluf Trolle* was very nearly built in the same way and from the same kind of materials as *Skjold.* But in addition to the difference in displacement and artillery, etc., there was also the constructional deviation, that the waterline armor with the armor deck lying on top only went to 5.5 m from the bow, where the armor on the two sides was connected by an armor traverse. The reason why the waterline armor had not been extended all the way to the bow was simply the desire to save weight.

The warship *Herluf Trolle* leaves the Krone Race on its last voyage (1930). (Photo from Orlogsmuseet archive)

The deckhouse, which was located between the two gun turrets, went somewhat further towards the ship's side than on *Skjold.* And a narrow "cow bridge" with coal filling holes was formed in the tables.
An armored casemate for a 15 cm cartridge gun was built into each corner of the deck house or superstructure.

In *Herluf Trolle* 's casemates, the ammunition elevators were placed respectively in the front and rear outside the boiler and engine rooms. The disadvantage of these low casemates was that cannon operation was difficult or completely impossible in rough weather.
In contrast to *Odin* and *Heligoland,* where the guns were in one large casemate, in *Herluf Trolle* there were thus four casemates with each gun and each isolated from each other and the other deckhouse by a semi-cylindrical rear wall

Essentially, the gun turrets were of the same type as in *Skjold ,* with balancing and hydraulic pivoting according to Canet's system. In *Herluf Trolle ,* however, the entire weight of the tower was carried by the hydraulic pressure. In daily order, the tower system was lowered so that with a conical ring on the underside of the tower floor it rested on a corresponding ring on top of the fixed tower well that went around the upper part of the rotating tower stem.

There was thus no horizontal runway. The lift height from the tower in rest position in daily order to maneuvering height during tower rotation was 20 mm. - The gun turrets, which had a firing range of 2x125°, could be rotated both electrically and by hand.
Access to the towers was usually through hatches in the tower roof, but like in *Skjold ,* access could also be made from the banjer deck.

The armored ship *Herluf Trolle* in 1902 in color 4. (Photo from the Orlogsmuseet archive)

The artillery was crucially different from the earlier battleships. Since now - at the same time as the transformation of the heavy guns in *Odin* - for the first time since the introduction of breech-loading guns, the wedge mechanism was abandoned and switched to screw mechanisms.
The new 24 cm guns were manufactured by the French company Schneider & Cie. and had Canet's screw mechanism with bracket and cylindrical bottom screw. The firing pin was Canet's cap firing pin for tower guns with recoil and advance for the cannon in the direction of fire, whereby the effects on the surface were smaller than with a sled firing pin, just as the gun port on the front side of the tower could also be made smaller.

The rate of fire was one shot per minute and the ammunition stock 60 shots per cannon.
In 1904, binocular sights were added to the original, more primitive aiming devices (falcon and notched mount). Later, an air blow-through device was added to prevent backflame when the mechanism opened immediately after a shot.

The ship's 15 cm cartridge guns were manufactured by Bofors in Sweden and had shared ammunition - i.e. that projectile and cartridge were separated separately. The charge was in a cartridge case, which formed a case seal as in an ordinary cartridge.
According to the contract, the rate of fire for the 15 cm cartridge cannon was to be at least 5 rounds per minute, but it was easy to get to 6, which could be pushed up to 7 after the ammunition elevators were rebuilt.

Of the 10 pcs. 57 mm cartridge guns were the 6 located on top of the superstructure, three on each side, and the remaining 4 one floor lower in small unarmoured, slightly protruding casemates - two on each side of the superstructure between the casemates for the 15 cm cartridge guns.

In 1910, 2 more were installed. 57 mm, which was placed on top of the two 24 cm gun turrets. Soon after, the four 57 mm from the small casemates in the sides of the superstructure were moved. From these casemates you had - especially at night - a poor view and overview, which is why the four guns were placed in better positions - partly in front of the superstructure in tables and partly on the aft bridge slightly below the aft searchlight.

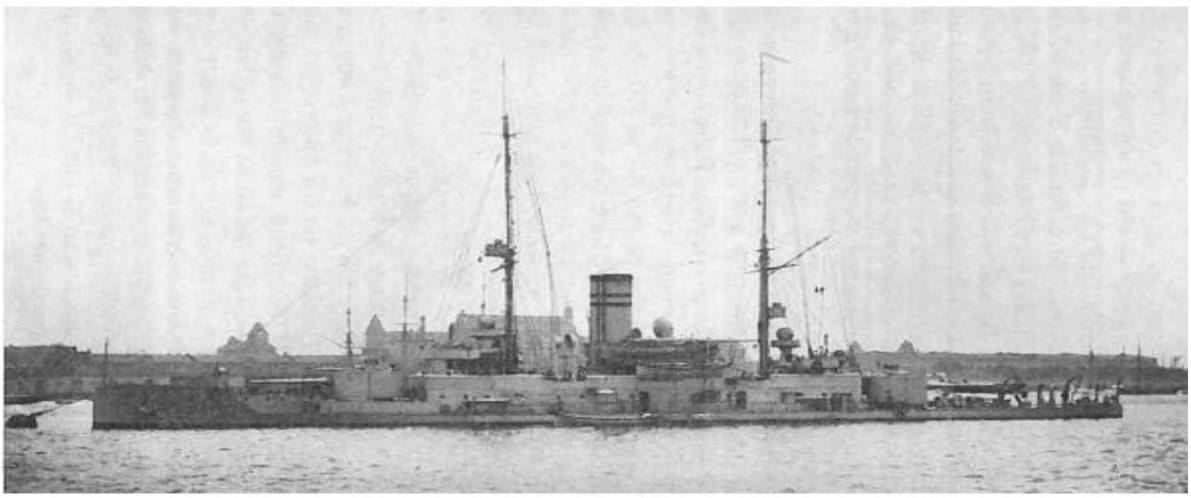
The two 57 mm cartridge guns on the gun turrets were replaced in 1916 with 2 pcs. 57mm anti-balloon guns. (Anti-balloon guns were the term for anti-aircraft at the time).

In 1917, the four 57 mm over 15 cm casemates were replaced with 75 mm Cartridge guns and the following year also the two 57 mm in the middle of the side of the superstructure roof, while the remaining four 57 mm Cartridge guns were removed.

By the end of 1918, the light armor had thus been changed to 6 pieces. 75 mm cartridge guns as anti-torpedo boat guns and 2 pcs. 57 mm anti-balloon cannon as combined anti-aircraft and anti-aircraft defense.
There were also machine guns for signal use and vessel arming.

In addition to a 37 mm revolver gun, the wood boat was also originally equipped with a rod torpedo device.

The torpedo armament consisted of three 45 cm underwater devices - one in the bow and one in each broadside. The two transom devices were supplied by Armstrong and stood in a common torpedo room, located approx. 30 m from the bow with the starboard device forward and the port aft



The coastal defense ship *Herluf Trolle* in 1910 with two red rings around the chimney. (Photo from Orlogsmuseet archive)

There were originally 2 units. 90 cm. Searchlights, which were placed partly forward of the jibmast and partly aft of the mainmast. These could be stowed under the armored deck - i.a. under clear sail by day.

The machinery consisted of two upright 3-stroke machines - built by Burmeister & Wain - each in a separate room. They got steam from 6 water tube boilers that stood on two separate boiler sites.
Range of action: 2400 nautical miles at 9 knots.

Herluf Trolle had, like the sister ship *Olfert Fischer* - as long as the two ships had color 5, i.e. up to and including 1906 - a tall spark rod on the big top. *Herluf Trolle* differed from her sister ship not only by the previously mentioned chimney for the auxiliary boiler and by having vessel davits and vessels on the aft deck, but especially by the two very large and recognizable equipped shooting or war masts, of which the mainmast was placed significantly lower than the jibmast .

During a major overhaul in 1907-08, *Herluf Trolle* two mærs were removed, and when *Peder Skram* had now also arrived after the test cruise in the autumn of 1909, it was found practical to be able to identify the three sister ships from a distance and to distinguish them from each other by giving the two of them red rings around the chimney.

The warship *Herluf Trolle* stands south in Drogden in the summer of 1930 with laundry to dry on the washing dinghies.
(Photo from Orlogsmuseet archive)

In 1910-11 *Herluf Trolle* had 2 red rings, *Peder Skram* only one. But then they switched, so that *Herluf Trolle* now got one red ring - *Peder Skram* two, As an admiral ship, *Olfert Fischer* got no rings.

After the two older sister ships had been decommissioned - with *Olfert Fischer* being the last in 1936 - *Peder Skram* ceased to have rings about the chimney.

Since the three sister ships in the years 1910-32 underwent the same changes in the exterior in terms of rigging etc., these changes can be listed together:

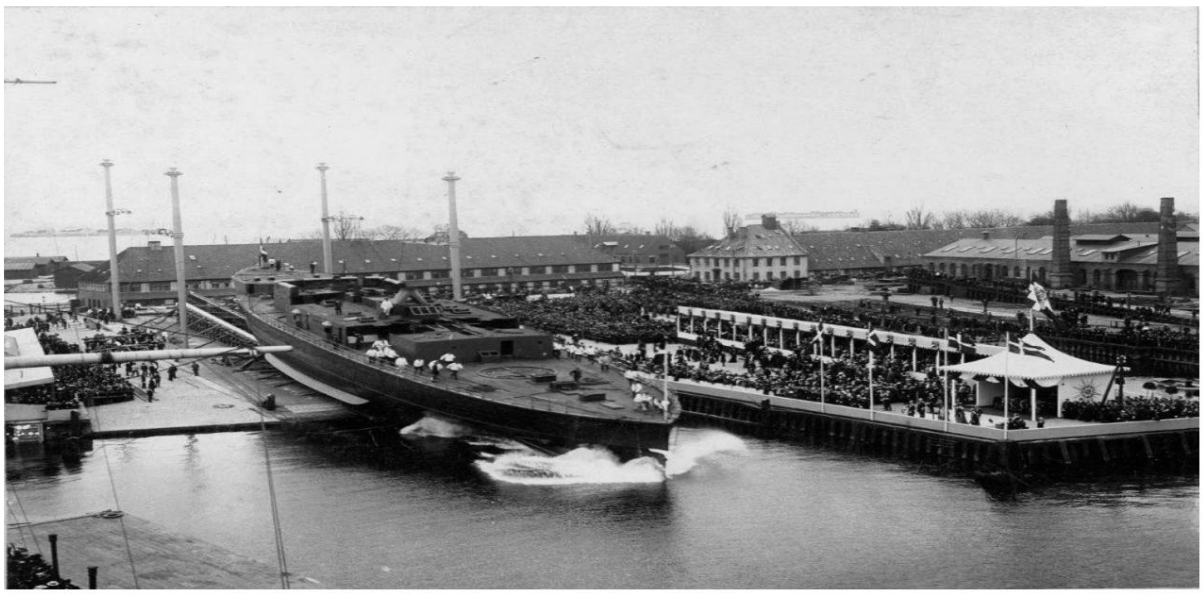
- 1909-14, all three ships had tall spark rods on both masts and a small open mast on the forecastle for lookout and impact observation.
- When the Security Forces increased in the first days of August 1914, they became tall spark rods stroked.
- In the early 1920s, the three ships were equipped with screens, and a little later a heavy lifting crane was installed aft of the port side to raise a sunken submarine.
- In 1927, when the development of radio equipment no longer required such high-placed antennas, the high spark rods were abolished.

The armored ship OLFERT FISCHER.

Not a year had yet passed after *Herluf Trolle's* launch before the drawings for the sister ship *Olfert Fischer* were approved on 2 July 1900, and shortly afterwards - on 20 October 1900 - the keel was laid.
In the time between the two ships, the development had of course brought a lot of progress. Different experiences from the prototype could also be taken into account in the new ship, but all in all, apart from the artillery, there were only minor improvements, whereby the two ships did not differ terribly from each other.

The mention of *Olfert Fischer* can therefore be limited to only the more significant changes.

Since the previous command ship *Heligoland* would reach the age of 25 in 1903, and thus had to be expected to be decommissioned before long. *Olfert Fischer* was fitted out as an admiral ship with accommodation for the squadron commander and his staff.



Olfert Fischer is launched on 9 May 1903. (Photo from Orlogsmuseet's archive)

In *Olfert Fischer ,* the waterline armor - unlike in *Herluf Trolle* - went all the way to the bow.
Both 24 cm guns (cardus charge) and 15 cm guns were manufactured by Bofors.
Both calibers had an Ogival bottom screw without a console and gradually got - like the 24 cm in *Herluf Trolle* - scopes and air blowing devices.
The freedom of lateral direction for the 15 cm casemate guns was a few degrees greater than in *Herluf Trolle.*
The ammunition stock was originally 65 rounds per 24 cm and 200 per 15 cm cannon, but were later changed to 70 and 165 respectively. The mechanical launcher was here moved by electricity with manual power as a reserve, and the performance of the ammunition elevators was increased.

In the "Handbook for the Navy" 1908, for the first time, the artillery is stated to - in addition to what is stated - consist of 6 pcs. 47 mm cartridge guns. Of these, one was placed on top of each of the 24 cm towers, two in the bridge wings and two on the aft bridge. However, these six 47 mm must have been added much earlier, as they can already be seen in photographs of the ship from 1905.

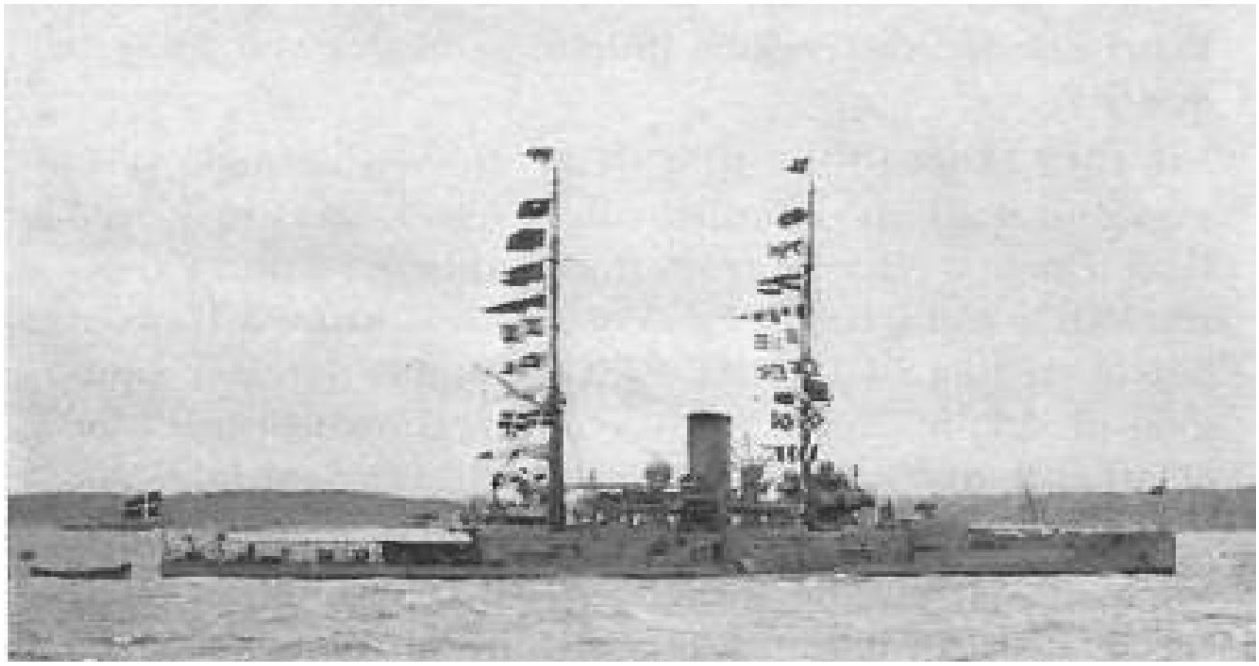
In 1910, all 47 mm were removed, and 2 were added. 57 mm that replaced the two 47 mm on the gun turrets. Shortly afterwards, the four 57 mm were redeployed from the small casemates in the sides of the superstructure, similar to the simultaneous redeployment in *Herluf Trolle.*
In 1916, the two 57 mm cartridge guns on the gun roofs were replaced with two 57 mm Antiballon guns, at the same time that the other ten 57 mm were removed and replaced with 6 pieces. 75 mm Cartridge guns as anti-aircraft guns. They were all placed on the superstructure, so that the anti-aircraft armament of the ship was the same and placed in the same way as in *Herluf Trolle.*

In addition, *Olfert Fischer* was granted three 37 mm revolver guns for signal use and arming the wood boat, which in the first years could also be equipped with a rod torpedo apparatus.
The torpedo armament was as in *Herluf Trolle,* but the transom's underwater devices were manufactured by the Norwegian Naval Service as improved versions of Armstrong's design.

Originally, like *Herluf Trolle , Olfert Fischer* should have had large gunnerys with 37 mm recoilless guns, but they exited under the building.

There were four searchlights - partly two 90 cm, which were placed on the wheelhouse in front of and on a pillar platform aft of the mainmast - and partly two 75 cm on pillar platforms in tables on the superstructure a little aft of the bridge. All searchlights could be stowed under the armored deck.
During the Security Force, the two 75 cm projectors were removed and replaced by two 90 cm. The position was then the same as in *Herluf Trolle* – two forward of the jibmast and two aft the mainmast.

The machinery was also in the main case as in *Herluf Trolle,* but both machinery and boilers were built by Orlogsværftet. However, the extension of the auxiliary boiler went into the chimney itself.
Range of action 2500 nautical miles at 9 knots.



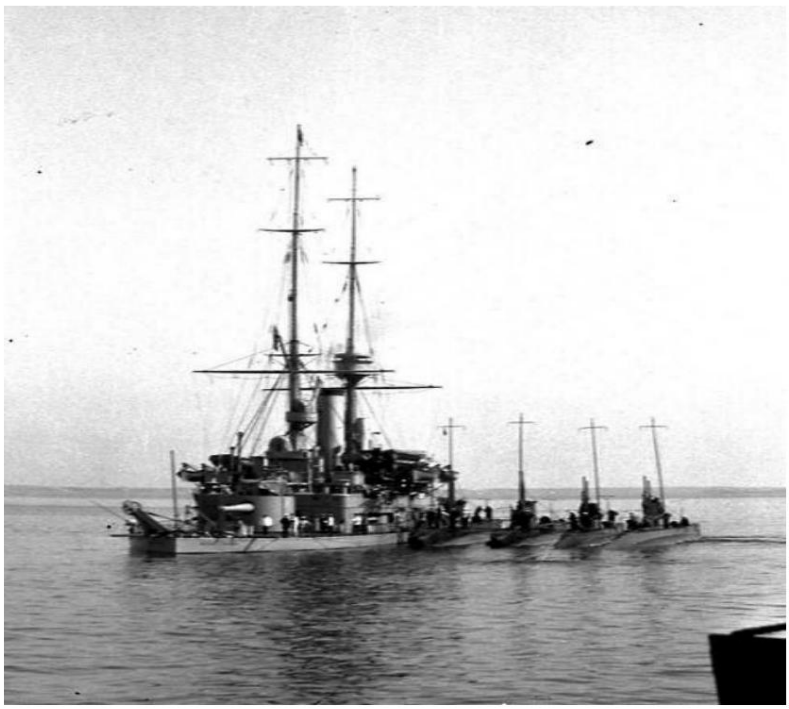
The coastal defense ship *Olfert Fischer* decorated with the flag during the Fleet Review on 24 June 1911 at Spithead on the occasion of the coronation of King George V. (Photo from Orlogsmuseet archive)

In 1912, *Olfert Fischer* - after a month's independent march with preliminary exercises - was at Humlebæk on 15 May, when intelligence arrived about the death of King Frederik VIII in Hamburg.
Vice-Admiral Kofoed-Hansen raised his flag in Olfert Fischer, who then, together with the royal ship, headed south through the Sound to pick up the late king's bier in Travemünde.

At Gedser, *Peder Skram* struck the flag, and the following day the squadron arrived at Travemünde.
Officers from the ships carried the King's bier on board, while unarmed crews formed trellises ashore.

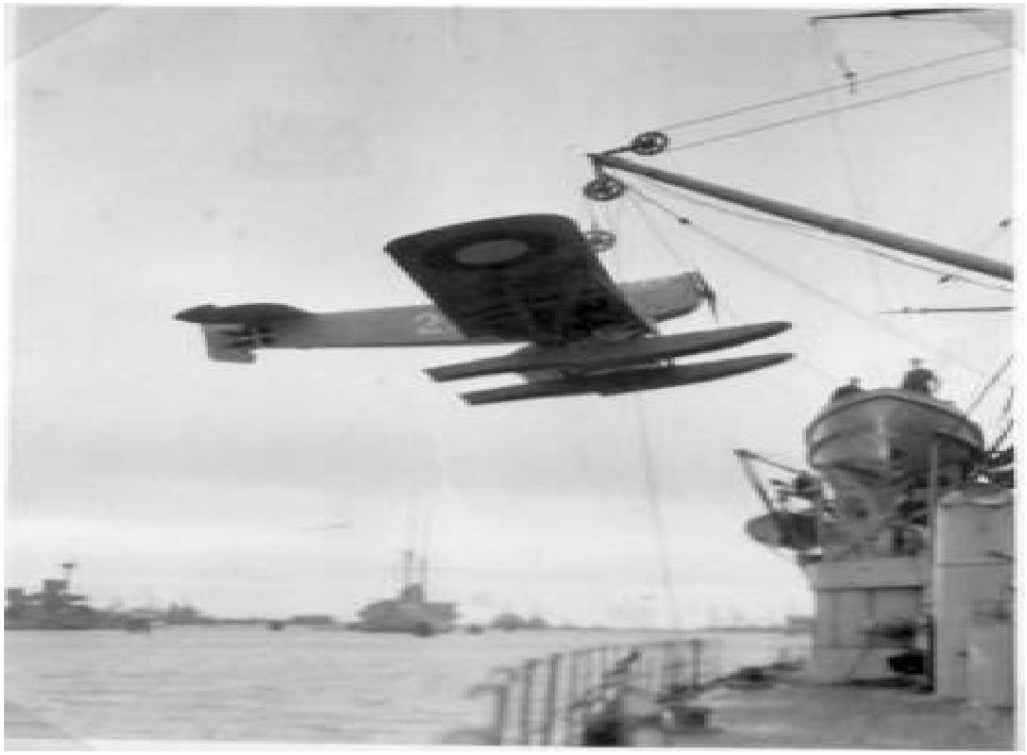
During the return journey, three German cruisers were passed at Gedser, which fired a mournful salute and then joined the rear of the Danish ships, which they followed for some distance on their way

The 17th of May. in the morning the mourning squadron arrived in Copenhagen.

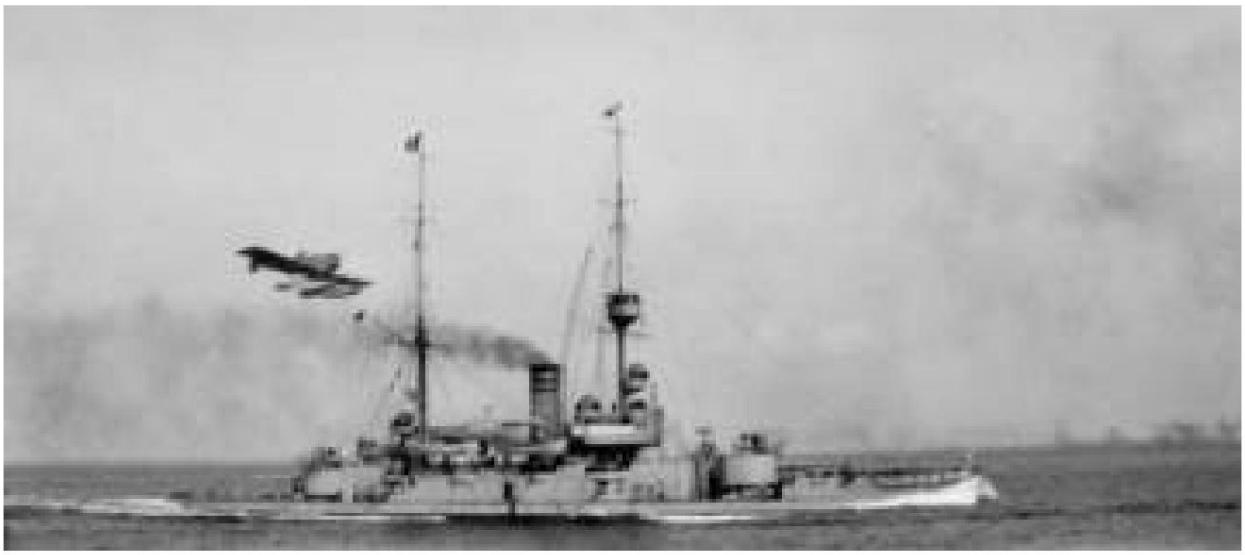


The warship *Olfert Fischer* with submarines on since 1926. Aft to port, the crane for salvaging a sunken submarine can be seen. It was last year with high spark rods.
(Photo from Orlogsmuseet archive)

In 1922, an attempt was made to turn *Olfert Fischer* - and *Peder Skram* into a kind of "aircraft carrier", as a naval aircraft of the type HM I, a pontoon monoplane commonly known under the designation Brandenburg, was "installed" on board for a time. The aircraft was lifted on board using the vessel's boom for amidships vessels and placed on the port side slightly aft of the chimney. However, the experiment was not entirely successful and was not later repeated in these ships.



Embarkation of an HM I naval aircraft in the coastal defense ship *Peder Skram* on Holmen during the summer squadron 1922. (Photo from Orlogsmuseet archive)



Coastal defense ship *Peder Skram* with air defense of its HM I aircraft during a submarine exercise in the Great Belt in 1922. (Photo from Orlogsmuseet archive)

Coastal defense ship *Peder Skram* with its "ship-based" aircraft HM 1 on board.
(Photo from Orlogsmuseet archive)

When *Olfert Fischer* was finally due to be scrapped in 1936, it was decided to use the old ship one last time. It was for the solution of a special task, after which the ship was not supposed to return as an artillery ship.

Everything that was found on board of more valuable installations and instruments that were not necessary for the solution of the task were taken out, such as some radio equipment, range finders, searchlights, fire control equipment and the light artillery. The chimney was cut over and its lower half, like the mortar, was covered by a roof.

Heavy timber constructions were built above and around the cannons. and these became like the roofs of the towers. the superstructure and deck protected by sandbags.
Thus "equipped", *Olfert Fischer* went on her last voyage in October (5-17 October 1936) as a target ship for bomb-dropping attempts from aircraft.

Aircraft from the Royal Navy's Air Force as well as from the Army's Flying Troops took part in the bomb-dropping that took place in Faxe Bay during which the ship was navigated from the armored command tower.

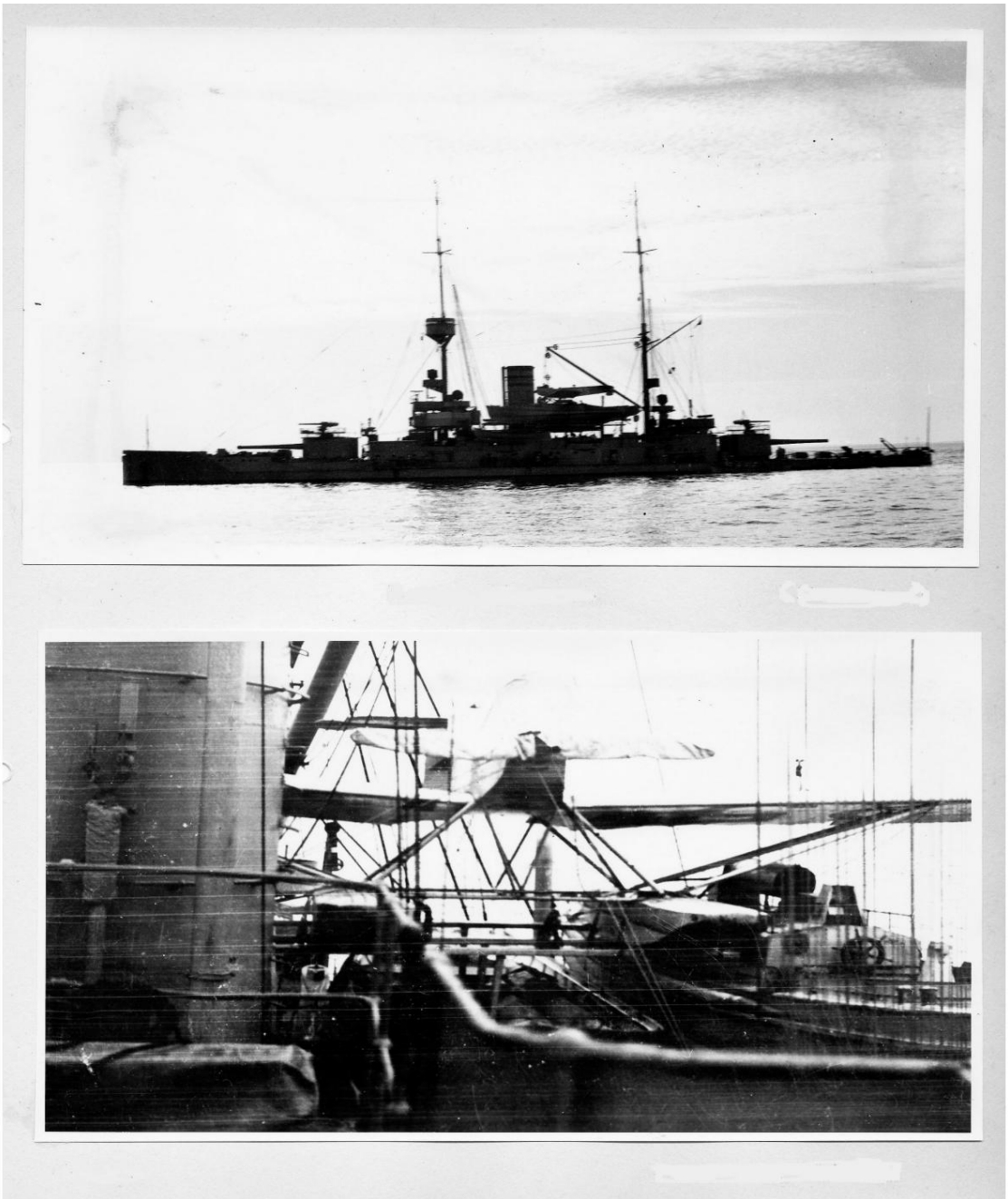
The artillery ship *Olfert Fischer* will leave the fleet on October 5 on its last voyage - as a target ship.
(Photo from Orlogsmuseet archive)

The armored ship PEDER SKRAM.

As the third unit of the Herluf Trolle class, *Peder Skram* was put on the stack on 25 April 1905.
(Photo from Orlogsmuseet archive)

The experiences from the two older sister ships led to quite a few minor changes in the construction of the third ship of the class. However, none of these changes broke the homogeneity between the three ships.
To save weight, however, as in *Herluf Trolle ,* the waterline had only been armored to 5.5 m from the bow.
Where the side armor ended with a transverse ship's armor traverse, in front of which the 65 mm thick armor deck from the lower edge of the side armor curved down towards the ram bow.

Both the two 24 cm guns and the four 15 cm guns were supplied by Bofors. In addition to binocular sights and air blast devices in both calibres, they also had 24 cm gyroscope sights. Whereby the firing of the cannons during the ship's movements at sea could be done with greater accuracy.



Coastal defense ship *Peder Skram* with his HM I aircraft on board.
(Photo from Orlogsmuseet archive)

In *Peder Skram* there was in the 24 cm gun turrets in the pivot bushing at the bottom - a special device which meant that the turret could also be rotated when the liquid pressure was removed and thus no longer "carried" the turret. In that case, however, the turning took place with somewhat less ease than when it rested on the glycerine with the hydraulic pivoting.
The shooting freedom for the 15 cm longships was increased from 120ÿ in *Herluf Trolle* to 133ÿ in *Peder Skram.*
It had originally been intended that the anti-aircraft defense should have consisted of 8 pieces. 75 mm and 8 pcs. 47 mm. However, with the ever-growing size of the fighters, the 47 mm caliber had to be regarded as too small for anti-aircraft protection. Even before the launch, it was therefore decided to abandon it and instead increased the number of 75 mm with two, which were placed on top of the gun turrets.

These two guns were replaced in 1916 with 2 pcs. 75 mm ABK (anti-balloon guns), which from 1923 were called ALK (anti-aircraft guns).
Compared to the two older sister ships, the torpedo armament had been increased with a 45 cm underwater device aft. An 80 mm nickel steel armored sight turret was for this device placed on the aft deck just aft of the gun turret.

There were originally four 90 cm projectors. The three stood in front of the jibmast - partly on the wheelhouse and partly in nests on pillar platforms in the bridge wings and all at the same height. The fourth searchlight was placed aft of the mainmast. During the Securing Force, the middle of the front three was moved up into a nest at the front of the jibmast, so that it was raised 3-4 meters above the two in the bridge wings.

At the rangefinders there were - just like in *Olfert Fischer* - transmitters for electrical distance indicators, which had receivers in the forward mast, the command tower and in the central command post, which was slightly below said tower.
In these three places there were transmitters for electrical order and distance indicators with receivers in the 24 cm towers and the 15 cm casemates. In addition, loudspeakers and loud telephones were used as means of communication.

Both machines and boilers were built by Orlogsverftet. Range of action 2,620 nautical miles at 9 knots.

PEDER SKRAM after the sinking on 29 August 1943.
(Photo from Orlogsmuseet archive)

In 1943, *Peder Skram* was laid to rest on Holmen.
As the situation between the Danish government and the occupying power gradually escalated in August, various measures of a defensive nature were taken on 27 August, and all units on Holmen were placed under the command of the Coastal Fleet

The events of 29 August do not need to be discussed in more detail here - it should only be mentioned that it was from *Peder Skram,* where the commander of the Coastal Fleet was with his staff, that the order to lower the Fleet was sent to the other units on Holmen.

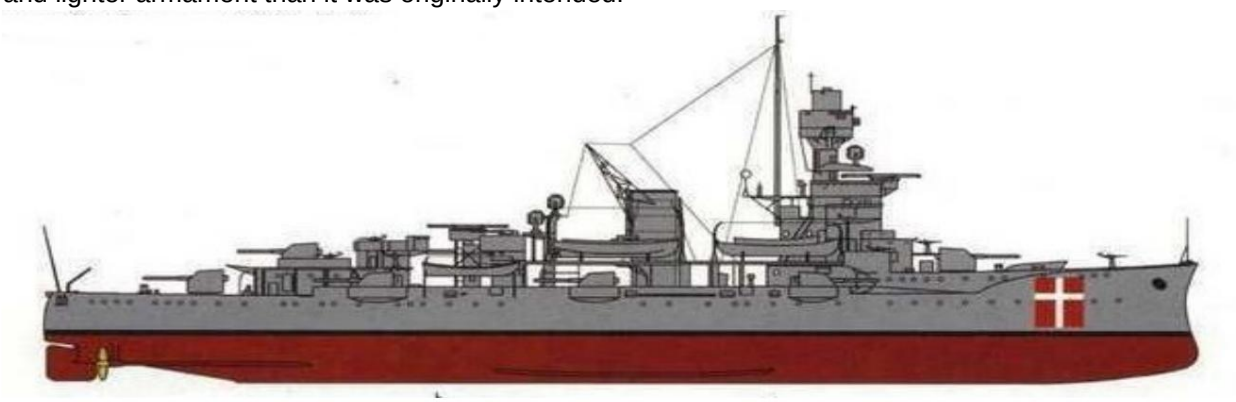
Peder Skram, which was under Nyholm's Mastekran, was sunk when the sea valves were opened.
Soon after, the ship was on the bottom with half a dozen degrees heeling away from the mast crane.

Somewhat later, the Germans sealed the ship and raised it - which, however, was hardly a particularly difficult job.

The four 15 cm casemate guns were taken out and set up in the battery "Pælebjerg" in Fanø Plantage. The two 24 cm remained on board in their turrets. *Peder Skram* was then towed to Kiel, where an emergency repair was carried out. The ship was armed with anti-aircraft guns and entered the German Kriegsmarine under the name Adler. The Adler was then anchored in the Kielerfjord as a stationary training ship and Flakschiff (air defense ship).
It was observed as such in January 1945 off Kiel-Friederichsort. As far as is known, the machinery has not been running since the lowering.
In April 1945, the ship was sunk again - this time by an Allied air attack. After Germany's capitulation, it was recovered by Svitzer during the summer and in September of the same year towed to Copenhagen.

Towed by one of Svitzer's tugboats, *Peder Skram* enters the Sound in the autumn of 1945. You see the empty casemates, and the waterline set aside by the sinking is still clear (Photo from Orlogsmuseet's archive)

In 1914, the construction of an artillery ship, the *Niels Juel,* began, but due to the World War the ship was not finished, and when it was finally finished long after the war, in 1923, it was given a completely different and lighter armament than it was originally intended.



Artillery *ship NIELS JUEL (Photo from Orlogsmuseet archive)*

Our first Submarines.

Oluf Aarestrup
(Photo from Orlogsmuseet archive)

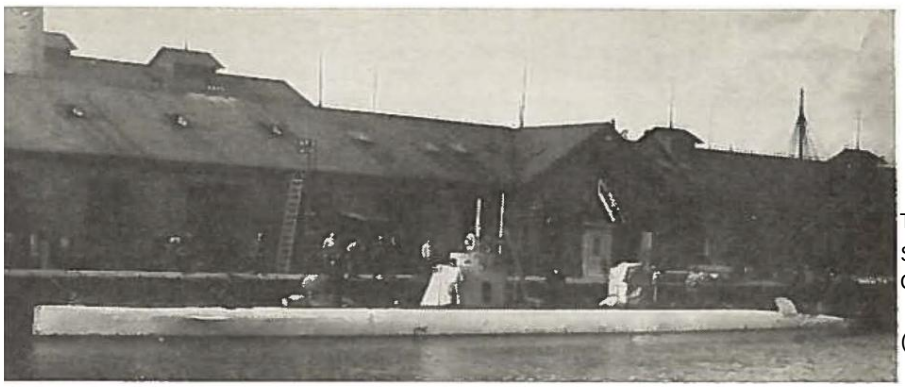
One of the major operators for the submarines was First Lieutenant O. Aaarestrup.
Already in 1901, Aarestrup's interest in submarines had been awakened.
He believed that the submarine would be an effective and suitable weapon in Danish waters.

During a voyage to the West Indies in the winter of 1901-02 with the cruiser *Valkyrie* , he had been given a letter of introduction to The Holland Torpedo Boat Company by an American naval officer, as it was expected that the cruiser would call at New York on the return voyage.

However, this did not happen, but Aarestrup continued the study of submarines after his return, and through theses, lectures and articles in journals and the daily press, he sought to arouse the public's interest in and understanding of submarines as an important part of Denmark's naval defence.
Among other things, in 1902 he lectured for the Finance Committee and the Defense Commission.

In connection with this commission, the submarine question was dealt with by a maritime commission whose members were naval officers and technicians from the Orlogsværftet. However, the acquisition of submarines was put on hold for the time being, as the commission partly believed that the current types were not yet sufficiently developed and, which seems less understandable - partly stated that our waters were not particularly suitable for submarines to operate due to the depth conditions.

In 1904, the Søe-Lieutenant-Selskabet awarded a prize thesis submitted by Aarestrup on submarines



The submarine *Dykkeren* moored in Søminegraven after arriving in Copenhagen.

(Photo from Orlogsmuseet archive)

In 1905, Aarestrup became involved with the Electric Boat Co. - the former Holland Torpedo Boat Co. - and Lake Torpedo Boat Co., as these two American companies were the only ones "selling" submarines at this time. At the same time, he requested the Ministry of the Navy to make a business trip to the United States, but when the negotiations through the diplomatic channels for permission to see the American boats ended in a refusal, the business trip had to be abandoned.

It may seem somewhat strange that visits by both Norwegian and Swedish naval officers and technicians could be arranged, while both Hovgaard and Aarestrup encountered difficulties.

But the difficulties were probably only there to be overcome, Aarestrup believed. Upon request he was granted leave with permission to travel abroad to see what he could achieve on his own and at his own expense and risk.

In America, Aarestrup managed - thanks to a suitable boldness - to be allowed to see some of the Electric Boat Co.'s newest boats, just as a number of plans and drawings were made available to him. Judging by the report, the visit to Lake Compagniet's office in Washington, on the other hand, turned out almost like a farce - and one gets the impression that Aarestrup did not have much respect for Lake's boats of the time.
The return journey went via Kiel, where the Germania yard and its German and Russian boats under construction were occupied. It was thus not so little that Aarestrup had achieved here on his own initiative

Later in the year and during the winter he again visited the shipyard in Kiel and then the Fiat-San-Giorgio shipyard in Spezia and a shipyard in Rotterdam, where engineer Laubeuf, who had retired from the French navy, was now working on various submarine projects.
These journeys and a visit to the Germania Shipyard in the summer of 1907 were undertaken together with various other naval officers and technicians from the Naval Shipyard. In the stays between trips, Aarestrup continued his information work and gave lectures on submarines - including for the then Defense Commission

The attitude towards the acquisition of submarines thereby gradually changed in a more favorable direction, both among the naval experts and among large sections of the Defense Commission's political members. In the final report on the tactical-technical background for the Navy's composition, the Defense Commission's appointed naval officers now advocated submarines as a component of the Navy, and in the commission report submitted in 1908, the majority recommended a force of 6 submarines.

However, the Naval Defense Act adopted as a result of the commission's work in 1909 did not specify any exact number of submarines. The law mentions at least 24 torpedo boats and submarines, leaving the door open for the possibility of a development-dependent shift in the number of the two ship types, without the need for a later amendment to the law for this reason.
But the new building account was, as is well known, small, and therefore at that time, before the adoption of the Navy Act of 1909, there were misgivings about using the modest funds for what was still considered to be an experiment. It was therefore absolutely necessary, in order for there to be any talk of getting a grant for a submarine pryed through, that it was a very cheap boat. On the other hand, it also had to be a good and suitable boat, otherwise the whole thing could suffer serious damage.

During a visit to the Germania shipyard, Aarestrup succeeded in persuading the shipyard's management to design a small, pure electric boat and offer it to the Marine Ministry at such a low price that the offer could seem tempting.

This was also successful, and the offer suited the then council president IC Christensen quite well. In and of itself, he would like to agree to building submarines, as they did not conflict with the party Venstre's demand that the defense should be purely defensive. But until now they had held back because of the cost.

With the Germaniaværftet's offer, however, it was possible to get a relatively cheap boat, and since at the same time some funds had become available through the sale of some decommissioned armored ships, it was decided to propose that the offer be accepted. Aarestrup believed, however, that offers should also be obtained from other companies, but this was not wanted.

When a naval officer and a designer from the Naval Mine Corps at this time - in 1907 - had to make a service trip to Fiume, Spezia and France to study torpedo and sea mine equipment, Aarestrup was given permission to participate in the trip, but with an express order not to to mention that Denmark intended to acquire a submarine, as they had already decided on the Germania boat as fully satisfactory.

However, this was not entirely in accordance with Aarestrup's views, as there were several things about the German project that he was not very enthusiastic about.
Aarestrup announced in all three places what demands the Danish navy made for a submarine, and requested that a project and offer based on this be sent to the Ministry of Marine.
After his return, Aarestrup was asked by the minister to appear in the Finance Committee to give a more detailed account of Germaniaværftct's offer, which they intended to accept. Here, Aarestrup took the opportunity to announce that bids had now also been received from other yards, and that some of these offers seemed to be better than those of the Germania yard - but admittedly also somewhat more expensive.

The minister became very angry about this, but it ended with all the offers received in the winter of 1907-08 being referred to a commission at Orlogsværftet for consideration.
There was unanimous agreement that in terms of price and technology the best project was from Fiat-San-Giorgio, and when, after some negotiations, it was possible to reduce the price to that of the Germania yard, the Italian offer was accepted, and the submarine was then finally put on the pile in Spezia in the spring of 1908.
As a submarine specialist, Aarestrup became a supervisor during the building, as he was assisted by various technicians from the Orlogsværftet

After standing on the stack for well over a year, our first submarine, which had been named the *Diver,* was put into the water at La Spezia on the Italian west coast on June 18, 1909. A few hours after the launch, it was able, under its own machinery, to make its first trial run.

The submarine *Diver* runs off the stable in La Spezia in Italy
(Photo from Orlogsmuseet archive)

The boat's main data were 105/132 tonnes displacement, length 34.7, width 3.3 and draft 2.2 m.
The reinforcement consisted of 2 pieces. 45 cm torpedo tubes forward. The pipes did not open into the bow itself as in the later submarines, as their mouths formed a severe bulb under the bottom some distance from the bow.

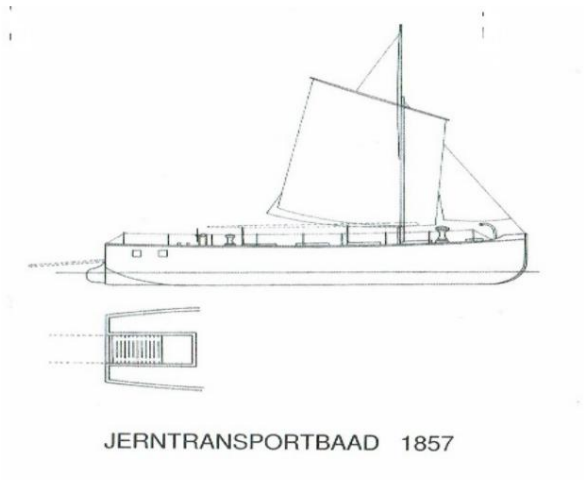
The crew consisted of 9 men, however, due to the training of new personnel, there could at times be some redundant crew members on board. The machinery, which as already mentioned was purely electric, consisted of two electric motors with associated accumulator batteries, each driving a separate screw with a maximum speed of 12/7.5 knots

The radius of action on the surface was 24 nautical miles at 12 knots and 100 nautical miles at 8 knots.

When the various tests in Spezia had proceeded satisfactorily, the boat was towed by Svitzer's salvage steamers Svava and Ægir to Copenhagen, where it naturally attracted both attention and interest upon arrival.

In order to trim the boat and train the crew, a long series of dives were held - first in Flådens Leje and later in Sundet. In the beginning there were some difficulties. As the boat turned out not to be properly balanced and the diving tanks not properly proportioned. Which immediately gave rise to some mistrust.

But when the various bugs were found and the deficiencies rectified, some successful attacks were made, first against stationary and later against moving targets. This changed the mood and when Dykkeren took part in exercises in the Sundet and showed what a submarine could do, there was no doubt that it would soon have more successors.



The diver initially had a permanent mooring place in the Søminegraven at the bulwark off the Sømine workshop, from whose power station it got its accumulators charged.

A full charge here took about a day, as the station's capacity was not designed to deliver larger currents.

As the conditions on board the boat were cramped and primitive, *Transport Boat No. 7* was laid up in the Søminegraven as a logistics and depot ship.

In the autumn of 1910, *Dykkeren* had a wireless telegraph installed as one of the first submarines in the world.

The submarine *Dykkeren* June 1914. (Photo from Orlogsmuseet archive)

As mentioned, the *diver* 's radius of action was rather poor. And with the only possibility of recharging from the Navy's power station, its operations were effectively limited to operations in the Sound with Copenhagen as its base.

In order to expand its area of operation somewhat, power cables were therefore run to the harbor quays in Helsingør and Rødvig and a charging station established. So that the boat could also be charged here.
Furthermore, there was the possibility that the boat could be towed by a coastal armored ship and have its battery charged from the ship's generators. However, such a charge took even longer than a charge from shore.

However, this emergency aid to increase the boat's radius of action did not have any major practical significance. Since the new boats that came into being in the following years had double engines. *The diver* therefore quickly transitioned to being used as a school boat, as during a possible state of war it was assigned to operate in the Sound as part of the capital's naval defence.

During his stay in Spezia, while overseeing the construction of the *Diver,* Aarestrup had made several trips to study diesel engines for submarines, including to Fiume, where he, together with Whitehead's designers, drew up drawings for a diesel/electric submarine that would fit our home waters.

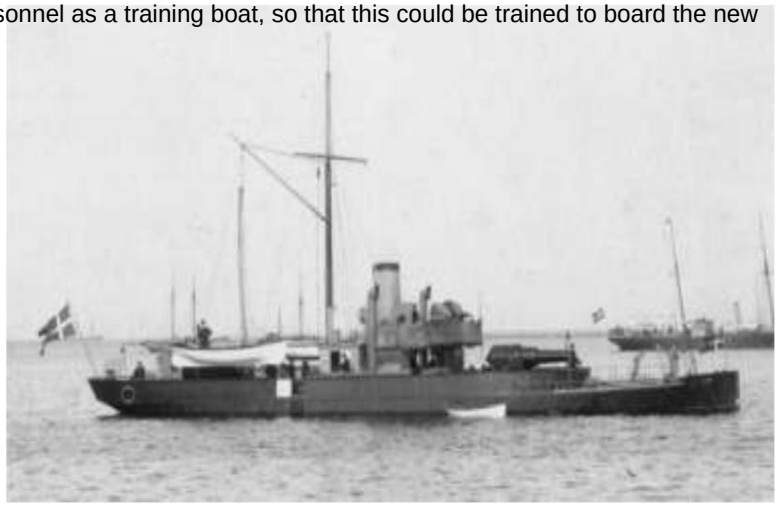
At Aarestrup's request, a similar diesel/electric project was drawn up by Fiat-San Giorgio, so that the next type of submarine could be considered immediately after *Dykkeren's* hopefully successful tests in the Sound.

When *Dykkeren* had convinced the authorities of the capabilities of the submarines and their usefulness in Danish waters, offers were also obtained from Whitehead, Fiat-San-Giorgio, Schneider and Germaniaværftet.

After a critical review of the offers received, Aarestrup traveled out again partly to discuss the projects with the various yards and see their latest boats and partly to study the progress in the area of engines, accumulators and periscopes.
The result was that they decided on Whitehead's offer, and after the new Navy Act had come into force, a contract was now concluded with this company for the construction of a boat, as the contract also gave a license for the construction of a similar boat at Orlogsverftet.

In the spring of 1910, Aarestrup left for Fiume to supervise the building of the new boat, after which a young First Lieutenant Rechnitzer took command of the Submarine Station and the *Diver.* On the same occasion, the submarine was assigned a number of personnel as a training boat, so that this could be trained to board the new boats.

As the space conditions in the old transport boat had thereby become too small, it was now only used as a depot and workshop ship, while the gunboat *Falster* from September 1910 was used as a logic ship.



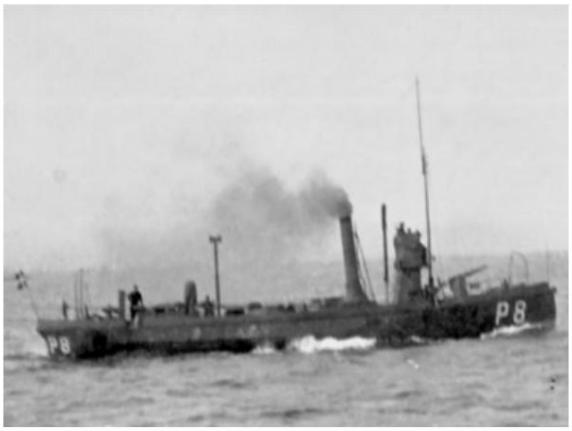
The gunboat *Falster* (Photo from the Orlogsmuseet archive)

The new boats had the following main data: standard displacement 164/204 tons, length 38.9m, width 3.6m and draft 2.3m, 430/270 HP and 13/10 knots.
The reinforcement consisted of 2 pieces. 45 cm bow torpedo tube. Crew: originally 10, later 14 men.

The 6-cylinder 2-stroke diesel engine in the boat built in Fiume, named *Havmanden,* was made by Fiat, while the boat built at Orlogsværftet, *Havfruen,* was to have a corresponding MAN engine of 450 HP.

The keel for *Havfruen* was laid in May 1911, and at the same time two more boats were ordered from Whitehead, *Thetis,* which began construction the same year, and *Triton,* which was begun in 1912.
The contract entitled two more sister boats, the *Najaden* and the *Nymfen,* to be built at Orlogsværftet , which also began in 1912.

This rapidly increased the number of our submarines. As early as December 1911, the Mermaid and in June 1912 Thetis ran *off* the *stable* in Fiume, and in August of the same year, the *Mermaid* followed here at home. As soon as the two boats in Fiume were ready - still without diesel engines - they were towed by Svitzer to Copenhagen and hoisted shortly after command.



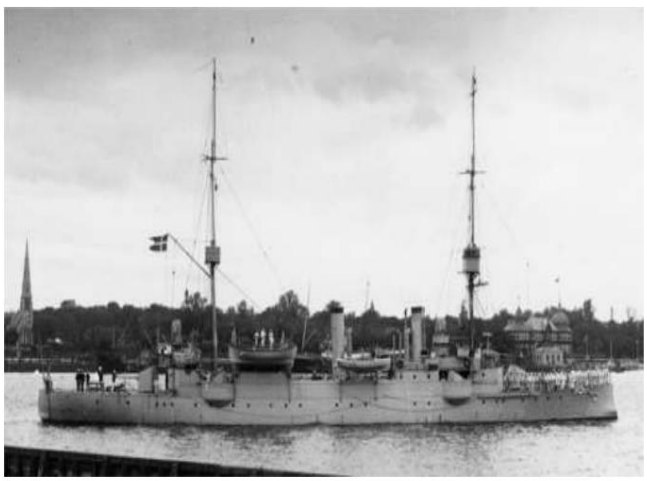
On 1 October 1912, the first submarine was launched division, consisting of *Dykkeren, Havmanden* and *Thetis* with the patrol boat *P 8* as companion boat, formed under the command of Captain H. Rechnitzer.

At about the same time, *Falster* ceased to be a logistics ship, as it was replaced by the cruiser *Geyser,* which had assumed command as the mothership of the submarine division entered into.

PATROULE BOAT NO. 8 (Photo from Orlogsmuseet archive).

After that, *Gejser* was moored at the southern bedding bridge on Nyholm, where in the spring of 1913 the submarines and *Transport Boat No. 7* were also given berths. The transport boat still served as a depot ship.

The submarine division, which had originally been mostly a tactical unit, now gradually took on a more permanent character and then quickly developed into an administrative concept as well.



The cruiser *Geyser (Photo from Orlogsmuseet archive)*

When the *Seaman* and *Thetis* took command, their diesel engines had not yet been installed, which is why these two submarines, as "temporary electrics", went very well with the *Diver.* The lack of weight of the engines was compensated with ballast placed in boxes, which from the maritime lore quickly got the name "box engines".

On 1 September 1912, Captain Aarestrup - after instructing *Havmanden's* crew - stepped outside his number to take over the position as director of the Electric Boat Company's branch in Paris. With his energy and endurance and his firm belief in the submarines, Aarestrup had carried his battle through and it was primarily due to him that at the outbreak of the First World War there was an effective Danish submarine weapon as an integral part of Denmark's naval defence.

According to the conditions of the time, the Havmanden boats were a successful construction and suitable for performing in coastal waters. It not only formed the basis for the following submarine classes, which were larger and improved versions, but also abroad - i.a. by Whitehead - built submarines with the Seaman boats as a pattern.

The submarines *Najaden* and *Havfruen* June 1914.
The A-boats originally had two three-piece radio masts. But in 1916 they got a light tilting mast, which could be lowered and raised more quickly when the boats respectively had to dive or had dived out. *(Photo from Orlogsmuseet archive)*

The first Danish-built submarine, *Havfruen,* took command on 21 March 1913 and shortly afterwards *Triton* was launched in Fiume and *Najaden* at Orlogsværftet.

The submarines had so far had the following identification numbers:

• H 1 - The Mermaid • H 2 - The Merman • T 1 - Thetis

It was intended that they would have continued with T 2 - *Triton* N 1 - *Najaden* and N 2 - *Nymfen,* but when *Triton* had its name changed to *April 2nd,* they switched to other identification numbers.

In 1907, the Danish Women's Defense Association was formed under the impression of the growing tension in Europe. The purpose was to work for the rearmament of the Danish armed forces. The association's approx. 50,000 members supported the defense collection in 1913.

And with this defense collection, sufficient funds had been received for DKF to donate a submarine to the Navy. But since it was not possible to get a suitable boat in any other way at this time, it was decided to "buy" *Triton,* the grant of which could then be used for the building of a new boat. In order to mark the national sacrifice that lay behind the provision of this submarine, the committee wanted to give it the name *2den April* - not only in memory of the actual Battle of the Rheden 1801, but also in memory of the will to defend itself, for which the Maundy Thursday battle in Kongedybet has become a national symbol

The submarines were therefore now given numbers starting with *Dykkeren* as 1 and *Havfruen* 2 and then the others in order from 3 to 7.

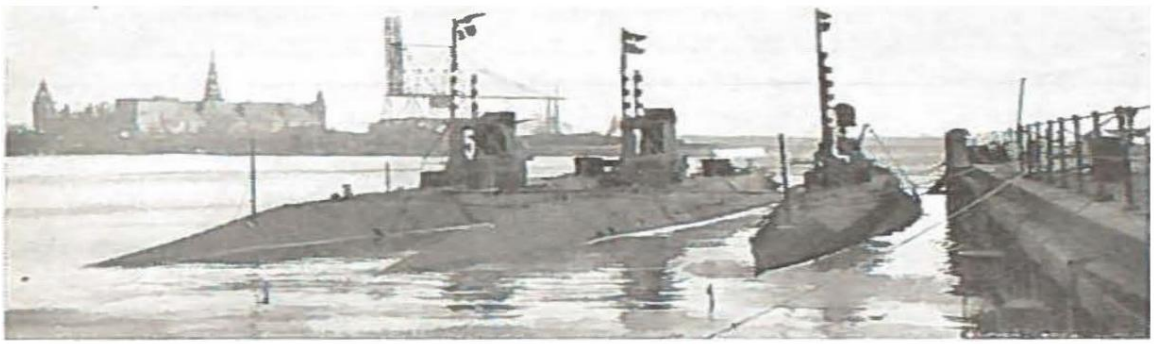
When the *Mermaid* came here before the *Merman* and *Thetis,* which were "older" calculated by launch date, it was because in March 1913 it was the first of our submarines to have its diesel engine installed and as a result was a command vessel.

The command was raised on *2nd April* in September 1913 and in December in *Najaden.* The same autumn, the command was struck off in *Geyser* as a mother ship, but the cruiser remained subordinate to the Submarine Division as a logic ship.

Since it had to be assumed that the boats could come out in wartime to have to operate independently of their base for some time, the most elementary comforts had to be provided - in order not to strain the crews unnecessarily.

In 1913, sleeping bags were thus acquired, and canned provisions were given out. In the alternating cold and heat of the submarines, the clothing was naturally more relaxed than in the other ships of the fleet.
The relationship between commanders and privates was also characterized by the fact that people lived close up and down one another - without the discipline therefore needing to suffer damage in any way.

Just as when the magnetic compasses proved to be rather unreliable, gyroscope compasses were gradually acquired.



The submarine station in Helsingør under the Security Force. From left: *2nd April, Nymph* and *Thetis.*
One notices the periscope covers, the pennants between the periscopes and the tail flags that indicated the stern of the boats

On 10 February 1914 *Nymfen* was launched at Orlogsværftet as the last of the Havmanden or A-class boats, and in July of the same year the command could be hoisted onto the seventh submarine.
But even before Nymfen was launched, the keel for the first two submarines of a new and improved class - *Ægir* and *Ran* - had been laid on Orlogsværftet's berths.

The Ægir class is also called the B class. As you will have noticed, the *Diver* was thus not included as a class, as it was only considered a test and school boat.
While *Dykkeren ,* as a designation, had the number 1 painted on the tower and the A-class the numbers from 2 to 7, the order then continued regardless of class with *Ægir,* which was given the number 8, to the last boat of the B-class, *Galathea,* as no. 12.
When the following first boat of the C-class was not given the number 13, but C 1 as a distinguishing mark, one cannot ignore the fact that superstition must have played a certain role, perhaps not because people in and of themselves were anxious that challenge fate, but perhaps more for the sake of the crew on board the boat.
Incidentally, the submarine, which in a sense should have been the Navy's thirteenth submarine - the sixth unit of the B class, was never completed. The superstition must thus be said to have received what was due to it.

The A-boats never had their class letter painted on the tower. It only happened to three boats of the B class, which in their last year of life had their markings 9, 10 and 12 changed to B 9, B 10 and B 12.
During the winter of 1913-14 and the following spring, several administrative and command changes took place.
The cruiser *Geyser,* which until now had been made available as a logistics and depot ship for the submarines, was thus exchanged with the cruiser *Hekla.*

Hekla is seen here in black paint. (Photo from Orlogsmuseet archive)

With the ever-growing administration and the increased personnel, the space in *Gejser* was gradually becoming too tight. However, since the cruiser was expected to be equipped in the event of mobilization, the necessary changes in the accommodation for its continued use as a depot ship were not to be made.
In *Gejser's* place, the two-year-old cruiser *Hekla* was therefore adapted as a depot ship - for the time being with its machinery on board.

Hekla took command on 7 January 1914, and for many years thereafter served as a station ship for the submarines.

Originally, it had been intended that it should also be used as a sailing mothership outside Copenhagen, but the war meant that this plan was never realised.

On 1 April 1914, the former U-boat division changed its name to the U-boat flotilla, with Captain Rechnitzer continuing as flotilla commander.

At the outbreak of the First World War, Denmark therefore had a relatively strong navy with well-trained crews and modern equipment.
Denmark's big problem, however, was that the country was within Germany's sphere of interest, but it was too far away from Great Britain to expect protection from it. Denmark was without alliances, and if there was a war between Germany and Great Britain, then one of the possibilities was that Great Britain would carry out an attack against Germany's Baltic coast down through the Danish straits.

So Denmark had to learn to balance on a knife edge and avoid provoking either one or the other party.

The loss of Southern Jutland was fresh in my mind, and one more misstep could lead to the loss of the rest of Denmark!

Copenhagen's fortifications

One of the political experiences from 1801 and 1807 was that the country's capital had to be able to be defended. At the end of the 19th century, a fierce political dispute arose over whether the whole country or just the capital should be defended. It ended with a massive expansion of the military defenses around Copenhagen. On the other hand, there were not many army forces outside the capital.

Middelgrundfort. Aerial photograph from the 1910s or 1920s.
(Photo from Orlogsmuseet archive)

When the First World War broke out in 1914, Copenhagen was the best defended capital in the world.

The strongest fort was the *Middelgrundfort,* which was built between 1890 and 1895 out on the Middelgrund - at a water depth of 7 meters - off the entrance to the port of Copenhagen.

In the period from 1910 to 1915, it was supplemented with another fort in Sundet, built on the land that was named Saltholm Flak. The fort was called the *Flakfort.*

Aerial photograph from a height of 500 meters of the *Flakfort.* Dated 31 May 1950 (Photo from the Defense Library)

The army stood for the most part, including the forts, while the navy could supplement with submarines, sea mines, torpedo boats, artillery-armed armored ships, etc. The command conditions were somewhat peculiar.
In 1899, it was decided that the management of *"Copenhagen's sea front"* should be subordinated to the commander of *"The Floating Defence",* who, however, in wartime was subordinated to *the High Command of the Army.*
This defense chief, usually a rear admiral, had the right in peacetime to inspect the naval forts and the training provided by the army to the crews.

A well-equipped fleet

The shallow water depths in Danish waters were and are suitable for mine defence, and cable mines had to be used to block navigable waters. Such minefields could be directed from land and armed or disarmed with a simple gesture.

To keep enemy minesweepers away, the minefields had to be defended, partly from the battery ashore, partly by artillery ships.

The armored ship *Herluf Trolle* in the original black/yellow paintwork. (Photo from Orlogsmuseet archive)

Artillery ships as well as torpedo and patrol boats were needed to safeguard against neutrality violations, just as a credible defense necessitated the use of submarines.

The Navy's Air Force is born

A forward-looking Ministry of the Navy began as early as August 1910 to investigate how flying training for naval personnel could take place. This happened just 6 years after Ellehammer's first skydive.

On 25 March 1912, the navy received its first aircraft, donated by a private person very interested in flying, Consul General Ludvigsen. In keeping with the navy's age-old traditions of naming its vessels, the aircraft was christened and given the name *Glenten.*

The aircraft *Glenten,* the navy's first aircraft, had a 50 hp engine and a top speed of 80 km/h.
(Photo from the Defense Photogallery)

In April 1913, the Navy received two more French two-seater Donnet-Leveque flying boats, purchased with private funds raised through a privately organized fundraiser. The flying boats were named *Maagen* and *Ternen.*
For the next two years, the aircraft and flying boats were located on Kløvermarken in Copenhagen, where a tent and a small hangar formed the operational platform.

Glenten on Kløvermarken and in the background you can see a Hawker Nimrod no 174 (Forsvarsgalleriet) 53

The fleet's very diverse voyages and operations between 1864 and 1914

The long period of peace from 1864-1914 gave the navy plenty of opportunities to show the flag around the world.

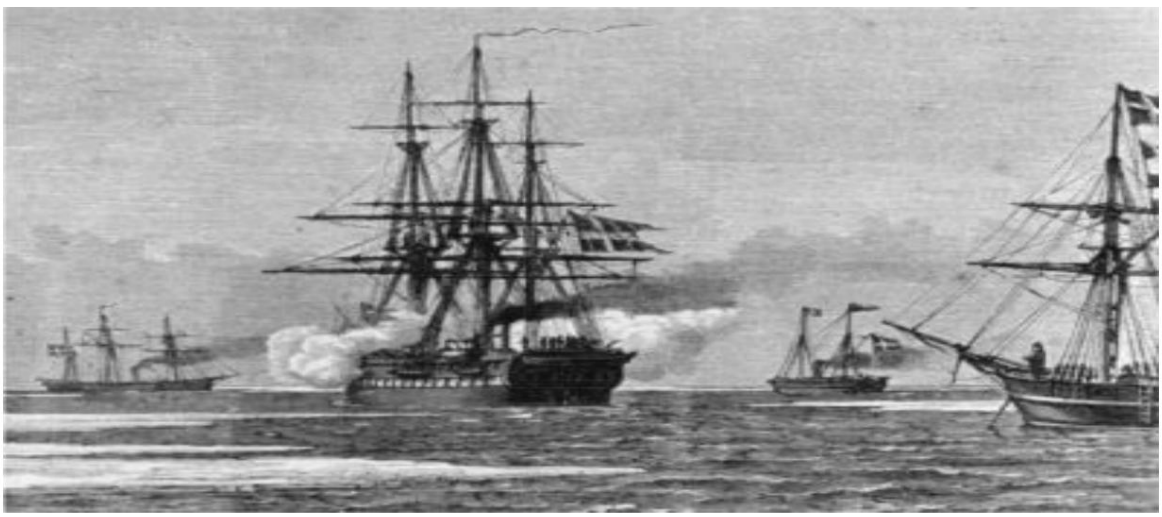
During this period, the term "fleet visit" arises, which can be used for a little bit of everything. Naval visits can be used in diplomacy, both as an outstretched hand and as a clenched fist. "Peaceful naval visits" have helped to support interest in Denmark and Danish export companies.
In the reign of Christian IX, royal and imperial yachts often came to Copenhagen, accompanied by foreign warships.

In 1870 – 1872, the screw frigate *Tordenskiold* was leased with a crew to Store Nordiske Telegrafselskab (the company is today called "GN": "Great Northern") for a voyage to East Asian waters, e.g. for the transport and laying of telegraph cable between China and Japan.

This cable was supposed to help connect Europe with the East via the Russian telegraph line in Vladivostok.

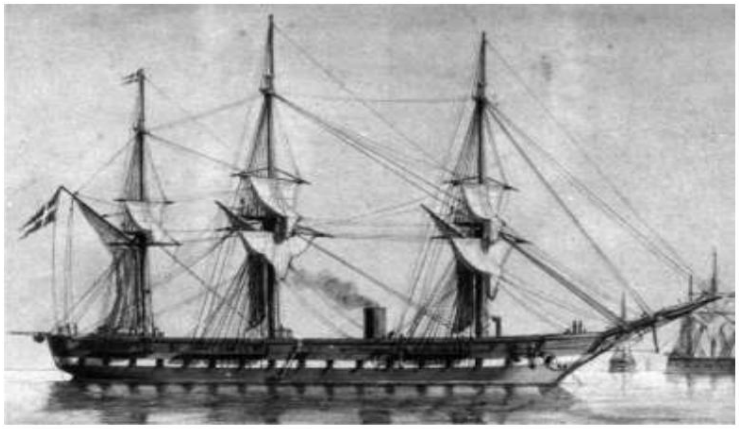
As time was precious to get the cable laid before the worst of the monsoon began, the screw frigate *Tordenskjold* was allowed - as the first ship ever - to sail through the Suez Canal before it officially opened. Captain Lund wrote in a letter home that *"Tordenskjold almost bumped over the bottom and occasionally also the mud barges"*

Tordenskjold returned to Holmen in January 1872 and in February of the same year it was withdrawn from the fleet number.



The screw frigate *Tordenskjold* leaves Copenhagen on 3 April 1870 on its almost two-year East Asian voyage.
(Drawing by Carl Baagøe, from the Orlogsmuseet archive)

The frigate *Sjælland,* under the command of Commander Rasmus C. Malthe Bruun, was in the Mediterranean in 1869-1870, where it participated as Denmark's representative together with 40 other warships in the opening of the Suez Canal, 17 November 1869.



Frigate *Sjælland* (Drawing from Orlogsmuseet archive)

In 1874, the navy sent a frigate and a corvette to Iceland to take part in the country's "millennial celebration". From 1876, the more regular scientific surveys began in Greenland, and the ships which were sent annually to Greenland by the Marine Ministry were instructed to also carry out sea surveys in the waters. The increased fishing around the North Atlantic areas meant that the fleet was slowly involved in fishing inspection in Faroese, Icelandic and Greenlandic waters.

In 1878, the screw frigate *Sjælland,* under Commander Johan C. Kraft, was sent to the Danish West Indies to *"put down a Negro rebellion",* as it was called at the time, but the cause of the rebellion dates back to the liberation of the slaves in 1848

In the West Indies, which were then a Danish colony, slaves who themselves or whose ancestors had been brought from Africa were used to carry out the rougher work. Since then they had lived under what we would call today inhumane conditions. To keep these people stuck in a daily life of hard work in the fields or in craft work, seafaring or as servants, a particularly harsh apparatus of repression was needed. In addition, Naval presence.

But in 1848, Denmark abolished slavery and it received royal confirmation by an open letter of 22 September 1848. At the same time, a regulation was issued, by which it was required of the freedmen to immediately seek legal employment through permanent work and enter into employment contracts of at least one year.

The abolition of slavery did not lead to better conditions for the slaves. In the past, a slave owner had some interest in keeping the slaves alive, but the day the slaves became wage earners, the slave owner lost that interest. Many plantation owners chose to import labor on one-year contracts, from among others Barbados, who, due to their greater efficiency, were more economical than the islands' own negroes. When it came to the attention of the farm workers on Saint Croix that the workers at the island's new joint sugar factory were paid significantly more than what they had been getting, it led to a revolt.

The rebellion had been put down when the frigate *Sjælland* arrived on 25 November 1878, but it had not gone completely bloodlessly.

In addition to the approximately 60 farm workers who died from gunshots from white Danes' guns, 12 were executed after being convicted by summary court verdict.

When the frigate returned to Denmark, seven people, four women and three men, were sent to Denmark to serve their sentences.

In 1895, *Gejser, Hekla* and four torpedo boats took part in the opening of the "Kaiser Wilhelm Kanal" (Kieler Canal). It was the first Danish naval visit to Germany since 1864!

The cruiser *Hekla.* (Photo from Orlogsmuseet archive)

The cruiser *Geyser* (Photo from the Orlogsmuseet archive)

Between 1899 and 1900, the cruiser *Valkyrien,* with commander HRH Prins Valdemar as commander, was on a voyage to, among other things, Siam (Thailand) and Japan to support Danish trade and shipping.

In 1901, the cruiser corvette *Valkyrie* was sent to the West Indies as a station ship. 11 May 1902, the ship was among the first to provide help after the volcanic eruption on 8 May at Mont Pelé in Martinique, where the town of St. Pierre was wiped out and 30,000 people perished. The *Valkyrie* managed to save 567 people

When the Russian Baltic Fleet sailed out of the Baltic Sea in October 1904 to take part in the war against Japan, it was "followed out" to Skagen by Danish units.

In 1908, the cruiser *Hejmdal* spent Christmas and New Year in Piraeus, the port city of Athens. Since the Danish prince Wilhelm, himself formerly a naval officer, had taken over the Greek throne, Danish warships had often visited Piraeus.

On 3 January 1909, the Ministry of the Navy ordered the ship towards Messina, where there had been a violent earthquake. Here, the ship was supposed to provide assistance to the distressed population after the earthquake

Cruiser Hejmdal. Dated 1922 (Photo from Orlogsmuseet archive)

Dark clouds are gathering in Europe

For several years after the 1864 war, the defense had stayed out of party politics, and until 1885 there was broad agreement on the strengthening of Danish neutrality policy.
With the Defense Scheme in 1909, the navy received larger grants for the acquisition of naval equipment, and in the years 1909-1914, 9 torpedo boats and 6 submarines were therefore part of the fleet. In addition, stocks of ammunition, torpedoes and mines were greatly replenished.

Denmark was thus in possession of both the will to defend itself and a powerful navy that could enforce Denmark's desire for neutrality when the dark clouds began to roll in over Europe in 1914.

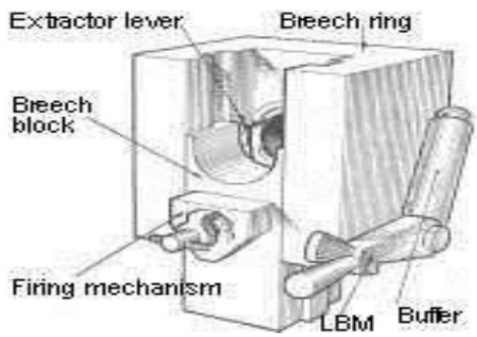
L.E.K

Explanations:

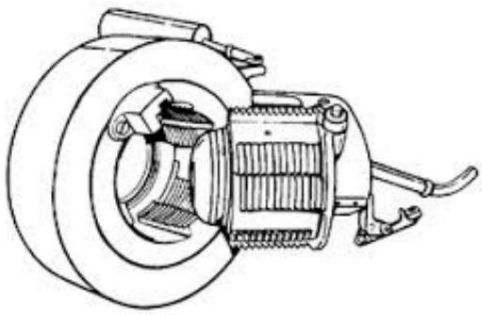
In connection with the text, two different variants of how the ships' main armament is operated are mentioned - namely forward guns and breech-loading guns. Both of these gun types' charge is two-part and consists partly of a projectile and partly of a gunpowder charge.

The difference between these two types is that with the forward cannon the powder charge is loaded first and then with the projectile, while with the breechloading cannon it is the other way around.

With the breechloading gun, there are two types of closing mechanisms, partly a wedge mechanism and partly a screw mechanism



Wedge mechanism



Screw mechanism

The wedge mechanism consists of a block that slides up and down in a slot and thereby opens and closes access to the barrel.

The screw mechanism, which is mounted on a hinge, is turned into the bottom of the barrel and rotated a number of degrees to lock and unlock respectively.

The text also mentions cartridge guns, and here the gunpowder charge is collected in a casing and the projectile is mounted at the top of the casing, thus creating what we today commonly call an artillery shell

However, these cartridge guns mostly did not have a caliber greater than 75 mm.

The last type of armament to be mentioned is the revolver cannon. This is a further development of the Gatling gun, but with a larger caliber for ship use than originally intended.

37 mm revolver cannon from the cruiser corvette Valykrien delivered to Masnedøfort 1914
(Photo Madsneøfortet).

PLAY