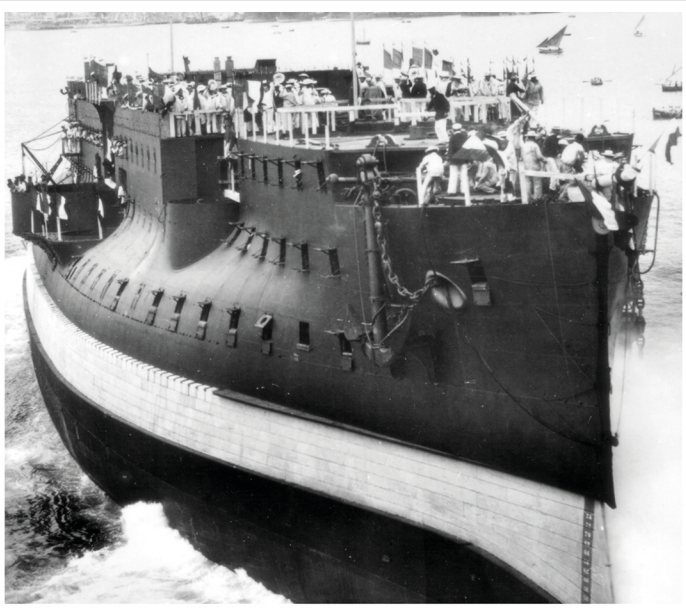
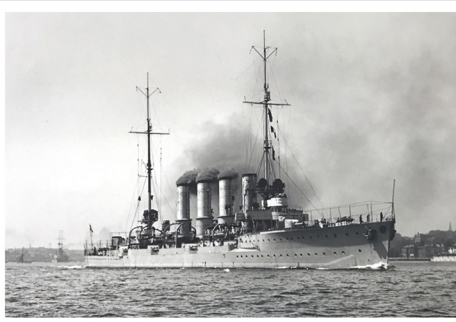
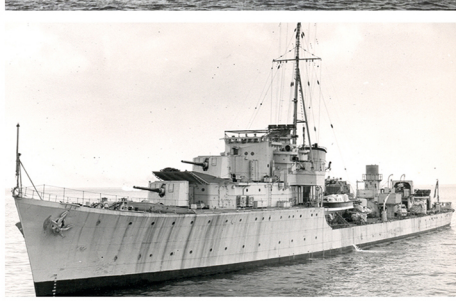
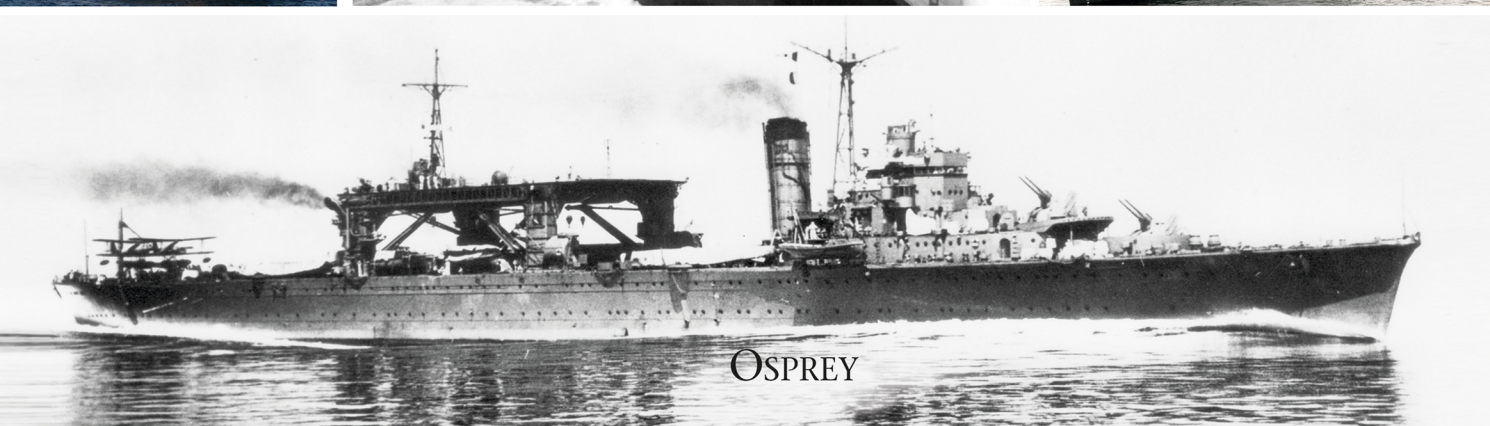
WARSHIP 2021

Edited by John Jordan









OSPREY

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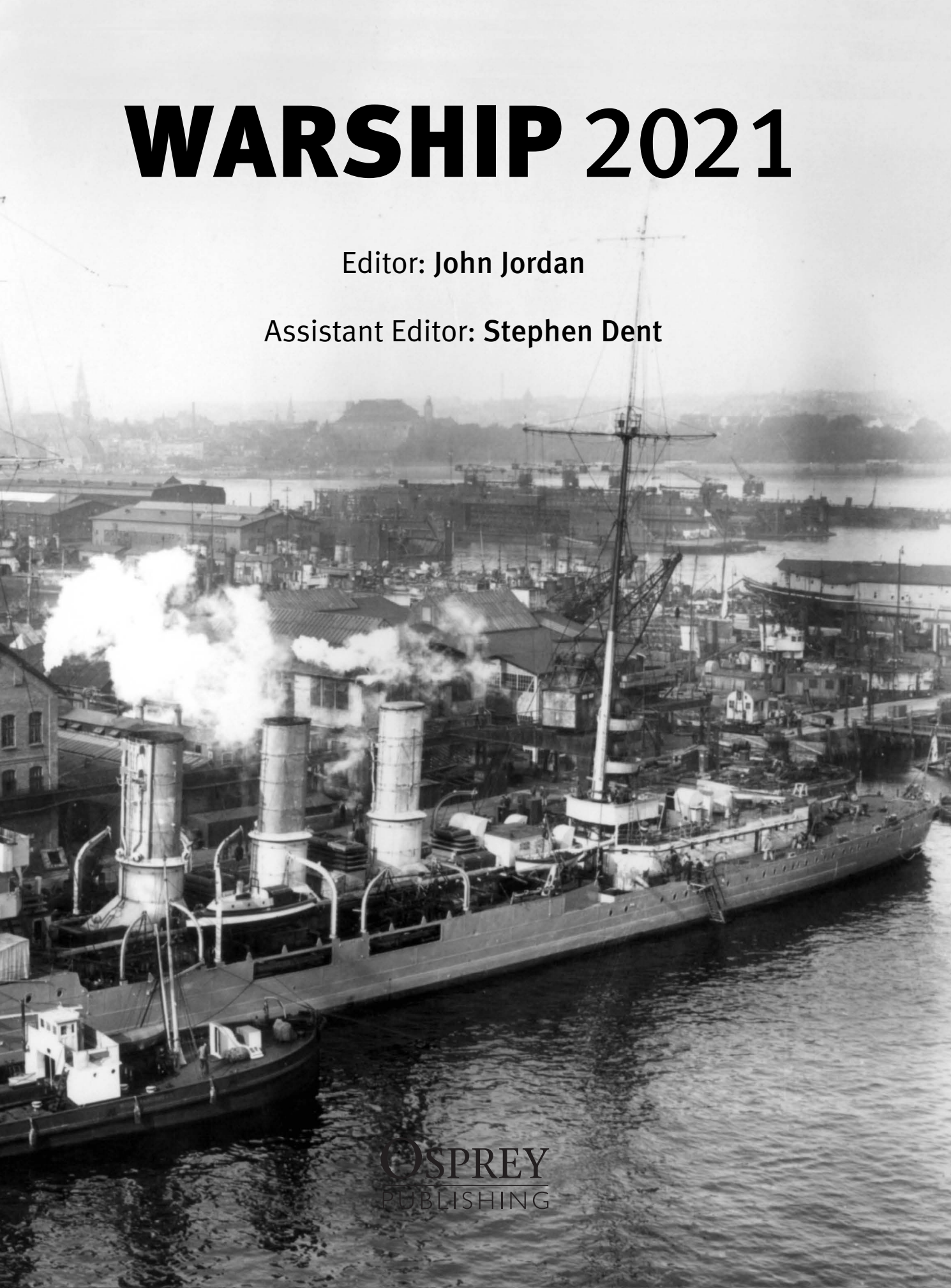
Editor: **John Jordan**

Assistant Editor: **Stephen Dent**



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Title pages: The German light cruiser *Regensburg* after rearmament with 15cm guns at the Imperial Dockyard, Kiel. The new configuration of the artillery on the forecastle is particularly evident in this picture, as are the two cut-outs amidships for the four 50cm torpedo tubes. *Regensburg*, together with her sister *Graudenz*, features prominently in Dirk Nottelmann's article on the German *Kleiner Kreuzer* published on pages 44–60. (Author's collection)

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EDITORIAL

Most of our feature articles deal with warships that were not only designed for a particular navy, but were completed and served for perhaps 25–35 years before being discarded, thereby providing ample opportunity for an evaluation of their qualities and of their suitability for adaptation to changed tactical or strategic imperatives. However, some designs never proceeded beyond the drawing board, while others failed to materialise because of circumstances: the outbreak of war and a consequent shift in priorities, or even invasion and its impact on military-industrial infrastructure. We are then restricted to the original plans, and at best photographs of hulls partially assembled on the slipway. Evaluation of a design for a ship or submarine that remained uncompleted is necessarily speculative and incomplete.

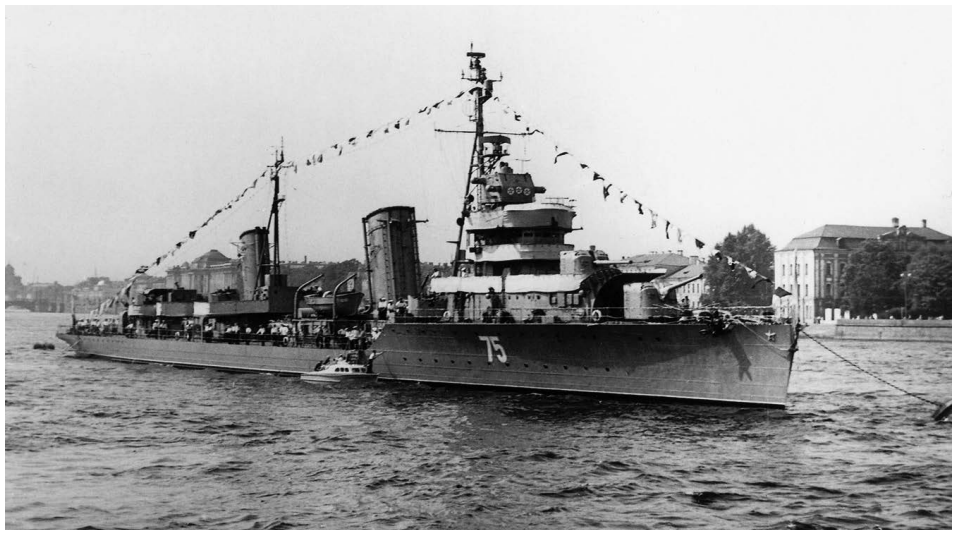
Despite this, 'paper' designs, or 'might-have-beens', have an enduring fascination for naval enthusiasts, and the internet has a number of forums dedicated to them. And for this year's annual we have opted to lead with an article on one such design: that of the Soviet 'super-battleships' of the *Sovetskii Soiuz* class, by regular contributor Stephen McLaughlin. The design process for these massive ships was enormously complex, and the result was a ship 'designed by committee', with every additional requirement being met by increasing size and weight to the extent that, had *Sovetskii Soiuz* been completed, she would have approached the Japanese *Yamato* in her overall dimensions and displacement. Considering the embryonic state of Soviet industrial infrastructure during the 1930s, this was a hugely ambitious project, which in the end came to nought – though not before four hulls had been laid down.

The West got its first glimpses of the *Sovetskii Soiuz* design in the late 1980s thanks to Gorbachev's policy of *glasnost*. However, the story told in these early articles was incomplete, and the drawings and model photographs published were not those of the final design. More detailed technical accounts, accompanied by plans of the many variants drawn up during the protracted design process, have recently been published in Russia, and Stephen has used these to shed a new light on these giant but never-completed battleships.

The Imperial Japanese Navy is represented this year by two unusual designs: the submarines of the *I 15* class and the seaplane carriers *Chitose* and *Chiyoda*. The *I 15* class was the culmination of Japanese interwar development of the large, fast 'fleet' submarine designed to operate at long range against the American main body during its transit across the Pacific, with the aim of reducing its numerical strength to a level at which it could be defeated by Japan's own battle fleet. Equipped with a catapult and collapsible floatplane, these submarines could operate independently or in packs. However, as Kathrin Milanovich's article makes clear, the Pacific War failed to develop in the way that the IJN anticipated, and these large, unhandy boats failed to make a contribution commensurate with the enormous investment of resources involved, achieving only a handful of spectacular but isolated successes. By contrast, the IJN's *Chitose* and *Chiyoda* suffered from being designed for multiple potential roles, only one of which could be performed at any given time. Hans Lengerer outlines the complex requirements and design process of these ships, which served first as seaplane carriers, then as mother ships for midget submarines (*Chiyoda* only) and finally, following a lengthy reconstruction, as light fleet carriers.

Coverage of the period 1930–45 is completed by two contrasting articles. Michele Cosentino follows up his feature in last year's annual on the Italian Navy's interwar carrier projects with an article detailing the redesign and reconstruction of the liner *Roma* as the aircraft carrier *Aquila*. The article takes advantage of material only recently unearthed from the Italian archives, and includes many plans and photographs which have not previously been published. Michael Whitby, on the other hand, addresses issues that are primarily tactical and strategic with an account of the employment of Royal Navy 'Fleet' destroyers to form the backbone of fast support groups at the height of the battle against the U-boats in the North Atlantic in the spring of 1943. The key quality of the fleet destroyers was their high speed, which enabled them to move quickly to support whichever convoy faced an imminent threat; however, contrary to what has been stated elsewhere, these newly-completed ships were not always equipped with the latest centimetric radars or HF/DF.

Elsewhere in the annual, Dirk Nottelmann continues his ground-breaking series of articles on the German *Kleiner Kreuzer*, this time covering the turbine-powered ships that accompanied the High Sea Fleet and the Scouting Groups during the First World War, together with the cruisers that were still on the stocks or fitting out when the war ended in November 1918. There is a particular focus on the adoption of the side belt, turbine development, and the rearmament of the older German light cruisers with the 15cm gun. To complete our coverage of the pre-WWI period, Philippe Caresse continues his series on the French battleships of the *Flotte d'échantillons* with a study of the battleship *Carnot*, arguably the least successful of the series. This year also sees the publication of a major new article by Ian Sturton on the Royal Yacht *Victoria and Albert (III)*, the design of which suffered from constant interventions by prominent members of the British royal family, resulting in weight miscalculations that led to the ship all but capsizing when floated out of Pembroke Dock, and the end of the otherwise unblemished career of the Director of Naval Construction, Sir William White.



The Soviet 'Flotilla Leader' *Leningrad* in her last years in combat service, photographed from the English Wharf in the Neva River in 1956. These ships will be the subject of a detailed study by Przemysław Budzbon and Jan Radziemski to be published in *Warship* 2022. (Przemysław Budzbon collection)

Conrad Waters has taken a well-earned break from his series on modern warship developments this year, leaving the field to the Editor and Jean Moulin, who have collaborated on an article on the French frigates of the *La Fayette* class that essentially ushered in the era of 'stealth' technology. Constructed of steel and glass-reinforced plastic (GRP), these ships featured completely smooth outer surfaces, with the hull and superstructures angled in such a way as to minimise the electronic signature. They inspired a new generation of frigates and destroyers, but proved difficult to modernise, in part due to funding issues but also because of the need to retain the integrity of the 'stealth' design. Finally, the Editor follows his short drawing feature on the French postwar 'fleet escorts' of the T 47 type with a similar feature on their successors of the T 53 class, which were laid down during the mid-1950s and were intended to accompany France's new carriers, *Clemenceau* and *Foch*.

Next year's annual will include a major study of the Soviet Flotilla Leaders of the *Leningrad* class by Przemysław Budzbon and Jan Radziemski, an article by Stephen McLaughlin on Soviet battleship design 1939–41 (Projects 23*bis*, 23NU and 24), an account of Operation 'Tunnel' and the loss of HMS *Charybdis* by Michael Whitby, and a feature by Kathrin Milanovich on the design of the IJN fleet carriers *Soryu* and *Hiryu*. Dirk Nottelmann will return with an article on the German cruiser gunboats of the late 19th century, and Peter Marland will continue his series on postwar developments in the Royal Navy with a study of radar.

John Jordan
March 2021

Clive Taylor (1947–2020)

We are sorry to report the death of Clive Taylor, who contributed the photographs of Royal Navy warships and the drafts of the accompanying captions for *Warship 2020*.

Clive began taking photographs of warships as a hobby in 1965, and after his marriage to Sue in 1970 they used the byline C & S Taylor for the specialist warship photographic agency they ran jointly until their retirement in 1995. During this period Clive and Sue were regular visitors to the Round Tower and the Walls at Portsmouth at weekends and during holidays, photographing many of the RN and foreign warships that entered or left harbour. The regular Round Tower photographers of the day formed something of a clique that tended to keep information about upcoming movements to themselves. As a young man who had only recently moved down from London and purchased his first SLR camera, I found Clive and Sue refreshingly open; Clive's enthusiasm was infectious, and he had a wealth of amusing stories.

Clive used an unusual medium-format camera: a British-made KL Biggs GP in an aerial body with a 180mm Zeiss Sonnar lens and a Linhof 6cm x 9cm roll film back. The camera had a fixed focal range, and was generally set up on a tripod on the wall close to the Round Tower, which for Clive provided the ideal angle for a vessel of frigate/destroyer size. He would sometimes charter a Cessna light aircraft for aerial photography; on other occasions, when offered the use of a helicopter by the Royal Navy, he would strap himself to the frame of the open door.

Clive and Sue were to become the foremost warship photographers of the day, contributing photos to international naval magazines and to prominent reference source books such as *Jane's Fighting Ships* and *Combat Fleets*. They also supplied photographs to several international intelligence agencies, including those of the USA, Germany and Japan.

The recently-published *Cold War Fleet* (Osprey Publishing, 2019), a compilation of the C & S Taylor photographs of Royal Navy warships taken between 1966 and 1991, will be a fitting legacy.

STALIN'S SUPER-BATTLESHIPS: THE *SOVETSKII SOIUZ* CLASS

The West got its first glimpses of the *Sovetskii Soiuz* design in the late 1980s thanks to Gorbachev's policy of *glasnost*. But the story told in these early articles was incomplete, and the drawings and model photographs published were not those of the final design. **Stephen McLaughlin** takes advantage of recent Russian publications to describe and illustrate the design of these giant but never-completed battleships.

Iosef Vissarionovich Stalin, chairman of the Communist Party and de facto head of the Soviet government, wanted a battle fleet. Why he wanted it is an open question, but by the mid-1930s the international situation certainly looked threatening. The economies of the capitalist nations were still mired in depression; there were ongoing clashes with Japan in the Far East, and Hitler's virulently anti-Communist Nazi party was firmly in power in Germany. To a dedicated Communist – and Stalin was indeed a dedicated Communist – all of this signalled the long-anticipated 'crisis of capitalism'. In his 'Report to the XVII Congress' of the Communist Party, delivered on 26 January 1934, Stalin predicted that this crisis would mean war, either between capitalist nations – in which case the Soviet Union had to be prepared to intervene in support of the proletarian revolutions that such wars might engender – or directly against the Soviet Union.[1] In either case a strong navy would be vital, especially if intervention were necessary in areas that the Red Army could not reach overland. Perhaps we need look no further than this for his motive in initiating a massive naval construction programme.

As early as 11 July 1931 Stalin had declared to his inner circle: 'It is necessary to start the construction of a great navy with small ships. It cannot be ruled out that in five years we will build battleships'.[2] But over the next few years the anti-battleship 'Young School' was allowed to dominate naval policy, and the survivors of the tsarist navy, the chief supporters of battleship construction, were viciously purged. Once Stalin believed that the USSR's economy and industry had reached a point where they could sustain a programme of battleship construction – almost exactly five years after his 1931 prediction – it was the turn of the Young School to be eliminated.

The entire machinery of the Soviet state would eventually be drawn into the battleship programme. At the top of that vast bureaucracy was the Council of People's Commissars, chaired by Stalin's long-time crony Vyacheslav Molotov and composed of the commissars (heads) of the various commissariats (ministries) – all Stalin's picked men. Another important body was the Council of Labour and Defence (from April 1937 simply the Defence Committee), also chaired by Molotov; it was essentially a subset of the Council of Commissars, with many of the same men serving in both. Stalin was a night owl, so the meetings began in the evening and lasted into the early morning hours; after an issue had been discussed it was common practice for Molotov to turn to Stalin and ask, 'How do we decide?'[3] All major decisions thus came from Stalin. Through these organs Stalin would approve ship characteristics and resolve technical disputes. One naval constructor noted:

> All of us … were greatly impressed by the detailed and deep examination of the complex tactical and engineering issues that took place at such a high-level meeting, and in particular the active and knowledgeable participation … of I V Stalin.[4]

The two principal institutions involved in designing the *Sovetskii Soiuz* class, the Navy and the shipbuilding industry, would both undergo administrative changes in the latter half of the 1930s. The Navy was initially part of the Red Army before being elevated to its own commissariat on 31 December 1937, which gave it direct representation on the Council of People's Commissars. Shipbuilding and ship design were concentrated in the Commissariat of Heavy Industry until December 1936, when the newly formed Commissariat of the Defence Industry took over that responsibility. In January 1939 this unwieldy organisation was broken up, and a Commissariat of the Shipbuilding Industry was created. In order to avoid confusion, throughout this article reference will be made simply to 'the Navy' and 'the shipbuilding industry'.

Designing ships was a back-and-forth process. The Navy would explore potential warship designs through its Scientific-Research Institute for Warship Construction (*Nauchno-isledovatelskii institut voennogo korablestroeniia*, NIVK), which included a small cadre of naval

constructors. They produced what amounted to feasibility studies to determine what was broadly possible. The result of NIVK's work would be a set of Tactical-Technical Requirements (*Taktiko-tekhnicheskii zadanie*, or TTZ) that would be sent to the shipbuilding industry, where they would be given a design (*proekt*) number and assigned to a construction bureau or, in the case of major warships, to two bureaux. Each would produce a sketch design (*eskiznyi proekt*), and the Navy would select the one it considered superior. Inevitably, the Navy would demand modifications to the chosen sketch design, and the winning design bureau would set to work on a technical design (*tekhnicheskii proekt*), which was equivalent to a contract design in the US Navy or a detailed design in the Royal Navy. In the case of the *Sovetskii Soiuz*, there were several successive technical designs as the Navy and the chosen design bureau sought to reconcile expectations with the realities of weights and hydrodynamics.

Each of these major steps in the design process had to be approved by the Government, usually by the Defence Committee. In effect, instead of being a direct negotiation between the Navy and the shipbuilding industry, the process became one of advocacy, with each institution arguing for its point of view before the highest officials in the nation – an analogy would find the merits of different design choices being judged by the British cabinet.

Designing the *Sovetskii Soiuz* Class

In the autumn of 1935 the Naval Academy (the Soviet naval war college) was ordered by the head of the Navy, V M Orlov, to study 'large armoured artillery ships' – the term 'battleship' was avoided, but that would soon change. The impulse behind this certainly came from Stalin, for Orlov would never have dared to launch such an initiative without his approval. The Academy's report, dated 8 September 1935, concluded that the Soviet Union required two types:

- Battleship 'A': Large ships for the Pacific and Northern theatres, capable of engaging any foreign ships in service or likely to be built in the near future; and
- Battleship 'B': Smaller ships for 'enclosed seas' – that is, the Baltic and Black Sea – whose primary purpose would be the destruction of Washington Treaty cruisers and German *Panzerschiffe*.

Work on determining the initial characteristics for the two types moved forward on two fronts, at the Navy's NIVK and the shipbuilding industry's Central Construction Bureau for Special Shipbuilding No 1 (*Tsentralnyi konstruktorskii biuro spetsialnogo sudostroeniia* No 1, or TsKBS-1). The result was a series of 'pre-sketch' (*predeskiznyi*, that is, preliminary) designs for a range of battleships. Most of these studies were completely unrealistic, but over the course of several months the Navy's more extravagant hopes were brought down to earth.

After reviewing all of these preliminary designs Orlov ordered that development be concentrated on a 55,000-ton ship with nine 406mm (16in) guns and a 450mm (17.5in) armour belt for Battleship A, and a 35,000-ton ship with the same main battery but a 350mm (14in) belt for Battleship B. The corresponding TTZ were issued to NIVK, TsKBS-1, and Construction Bureau No 4 (*Konstruktorskoe biuro* 4, or KB-4) – based at the Ordzhonikidze (Baltic) Works – on 21 February 1936.

However, international events soon forced a major change in priorities. On 25 March 1936 the Second London Naval Treaty was signed by France, Great Britain, and the United States. It confirmed the 35,000-ton displacement limit established by the Washington Treaty, but reduced the maximum gun calibre to 14in (356mm). Although the Soviet Union was not a signatory, at this time it was pursuing a policy of 'collective security' in an attempt to curb German and Japanese aggression, so in May 1936 negotiations began with Great Britain for a bilateral naval agreement that would bring the USSR into the treaty system. As a result, Battleship A was downgraded to a 35,000-ton ship, while Battleship B became a 26,000-ton ship armed with 305mm (12in) guns. Some work continued on 55,000-ton designs, still regarded as necessary for the Pacific theatre to counter the powerful Japanese fleet.

In June 1936 TsKBS-1 and KB-4 submitted their 35,000-ton designs. KB-4's strongly resembled HMS *Nelson*, with all the main-battery turrets forward of the superstructure, while TsKBS-1's proposal featured two turrets forward and one aft. The Navy preferred the latter arrangement for tactical reasons, and it would thereafter be used in all the design work. However, this phase made it very clear that the inexperienced Soviet designers would need a great deal of assistance if real progress were to be made: many features of these 35,000-ton designs were vague, almost cartoonish.

Italian Input

The most promising source of such help was Fascist Italy. Italian technical assistance – including Italian constructors working in TsKBS-1 – had played an important role in the design of the *Kirov* (Project 26) class cruisers and the construction of other warships, so when the Italian firm of Ansaldo offered to draw up battleship designs in March 1936, the Soviets eagerly accepted. The head of TsKBS-1, V L Bzhezinskii, was sent to Italy to work out the details. On 10 June the head of the shipbuilding industry, R A Muklevich, telegraphed instructions and encouragement to Bzhezinskii: 'Try to get the *Littorio* design. What is needed is a battleship of 35,000 tons.[5] This is the main task. The next design should be this: displacement 26,000 tons …'.[6] Muklevich also wanted Italian designs for large cruisers and an 'armoured scout'.

The fruits of Ansaldo's labours arrived in Moscow in July 1936. The large battleship design, designated UP.41, was for a ship with a standard displacement of 42,000 tons that bore a strong resemblance to the *Littorio* class. This was no accident, as it was in fact a design worked

out for the Italian Navy by Umberto Pugliese's department in 1934–35 as a potential follow-on to that class.[7] That possibility had been set aside in favour of building a second pair of *Littorios*, so UP.41 was available for trading to the Soviets; apparently the only modification made to it was the replacement of the triple 152mm secondary turrets by triple 180mm turrets as in the *Kirov* class cruisers – ironically, a calibre the Soviets had never intended to use in their battleships.

The Ansaldo materials arrived at an opportune moment, for the Navy had begun to doubt that the desired characteristics in speed, protection, and firepower could be achieved in a 35,000-ton ship. UP.41, produced by the highly-regarded Italian designers, probably confirmed this view. Although the Soviets never considered building a battleship to the Italian design, it did have a considerable influence on the next stage of the design work, as can be seen if it is compared to the TTZ

Table 1: **Battleship A – Preliminary Designs, 1936**

Column	A UP.41	B TTZ[1]	C TsKBS-1	D KB-4
Date	14 Jul 1936	3 Aug 1936	Oct 1936	Oct 1936
Displacement:				
standard	42,000 tonnes	41,500 tonnes	44,900 tonnes	45,930 tonnes
trials	45,470 tonnes	N/S[2]	46,700 tonnes	51,030 tonnes
full load	— [3]	N/S	50,000 tonnes	—
Length:				
overall	252m	N/S	251m	255m
waterline	245m	N/S	245m	—
Beam:				
maximum	35.5m	N/S	33.6m	33.5m
waterline		N/S	33.1m	31.5m
Draft (maximum)	9.4m (normal)	9.5m (damaged)	9.8m	9.5m
Block coefficient	—	N/S	0.595	0.635
GM (standard)	—	N/S	3.0m	2.2m
Armament:				
main guns	9 x 406mm (3 x III)	9 x 406mm (3 x III)	9 x 406mm (3 x III)	9 x 406mm (3 x III)
secondary guns	12 x 180mm (4 x III)	12 x 152mm (6 x II)	12 x 152mm (6 x II)	12 x 152mm (6 x II)
HA guns	24 x 100mm (12 x II)	12 x 100mm (6 x II)	12 x 100mm (6 x II)	12 x 100mm (6 x II)
light AA	48 x 45mm (12 x IV)	40 x 37mm (10 x IV)	40 x 37mm (10 x IV)	40 x 37mm (10 x IV)
Catapults	1	2	2	2
Aircraft	4	4	4	4
Protection:				
main belt	370mm at 6°	380mm	380mm at 5°	380mm at 5°
upper belt	150mm at 6°	250mm	200mm at 5°	220mm at 5°
belt forward	—	200mm	125–90mm	200mm
forecastle deck	55mm	30mm	30mm	30mm
upper deck	10mm	50mm	50mm	50mm
main deck	25mm, 100mm[4]	135mm machinery 180mm magazines	135mm machinery 180mm magazines	135mm machinery 180mm magazines
turrets	400mm faces	425mm faces	425mm faces	420mm faces
barbettes	350mm	425mm	425mm	420mm
Underwater protection:				
system	Ansaldo	N/S	Ansaldo	Pugliese or Ansaldo
depth	9.8m (amidships)	not less than 7.5m	7.3–7.5m	–
Machinery	4-shaft turbines 4 x 45,000shp	N/S	3-shaft turbines 3 x 60,000shp	3-shaft turbines 3 x 66,700shp
Speed	32 knots	30 knots	30 knots	30 knots
Range	6,300nm/20kts	6–8,000nm/14kts	7,000nm/14kts	7,000nm/14 kts
Complement	1,600	1,373	—	1,360

Notes:

1 TTZ = *Taktiko-tekhnicheskii zadanie* (Tactical-Technical Requirements).
2 N/S = Not Specified
3 — = Data not available
4 UP.41 deck armour in four layers; the middle deck was 100mm.

Sources: Vasil'ev, 21, 52; Garzke & Dulin, *Battleships: Allied Battleships*, 310.

worked out by NIVK and approved by the government in August 1936 (see Table 1, cols A & B). According to the major historian of the *Sovetskii Soiuz* class, the displacement of 41,500 tons was 'based on Italian experience and [NIVK's] own previous studies …. The authors of the TTZ were well aware that it was almost impossible to establish visually such a small deviation from the treaty limit'.[8] So, like the Italians and the Germans, the Soviets hoped to pass off battleships of more than 40,000 tons as 35,000-ton ships.

The Early Soviet Designs

At this point the TTZ were handed over to the shipbuilding industry, which designated the work as Project 23 and assigned TsKBS-1 and KB-4 to work out sketch designs for both battleships A and B. The constructors faced a difficult task: experimental work on underwater protection had barely been started, and all the guns and mountings, as well as fire control equipment and much else, were in the earliest phases of development, so many weights could only be estimated. As a result, both sketch designs were very incomplete when they were examined by the Council of People's Commissars, with Stalin in attendance, on 2 November 1936.

Both designs for Battleship A exceeded the specified displacement by a considerable margin; moreover, in an attempt to minimise the excess tonnage, the two design groups had shaved some armour thicknesses (Table 1, cols C & D). The designs shared a number of features, including the general hull form (inclined sides, bulges, a long forecastle deck), which had been developed by NIVK in early June. Another common element was the use of a three-shaft machinery plant, based on the belief that a four-shaft plant would be heavier and make it difficult to provide a full-fledged side protection system in the after part of the citadel. And both designs had very densely packed citadels, squeezing some of the 100mm AA guns out onto the quarterdeck.

But there were also significant differences: TsKBS-1's

Table 2: **Project 23 Technical Designs, 1937–1938**

Column	A TTZ	B Variant I	C Revised TTZ	D Variant III	E Variant IIIu
Date	26 Nov 1936	June 1937	July/Aug 1937	Nov 1937	Feb 1938
Displacement:					
standard	46–47,000 tonnes	48,415 tonnes	55–57,000 tonnes	57,850 tonnes	58,500 tonnes
full load	N/S	—	N/S	63,900 tonnes	64,460 tonnes
Length:					
overall	N/S	—	N/S	271m	271m
waterline	N/S	237m	N/S	260m	260m
Beam:					
maximum	N/S	36.5m	N/S	38.5m	38.9m
waterline	N/S	—	N/S	36m	36.4m
Draft (maximum)	10.0m	10.3m normal	10.25m	10.35m	10.4m
Armament:					
main guns	9 x 406mm (3 x III)	9 x 406mm (3 x III)	9 x 406mm (3 x III)	9 x 406mm (3 x III)	9 x 406mm (3 x III)
secondary guns	12 x 152mm (6 x II)	12 x 152mm (4 x III)	12 x 152mm (6 x II)	12 x 152mm (6 x II)	12 x 152mm (6 x II)
HA guns	12 x 100mm (6 x II)	12 x 100mm (6 x II)	12 x 100mm (6 x II)	12 x 100mm (6 x II)	8 x 100mm (4 x II)
light AA	40 x 37mm (10 x IV)	40 x 37mm (10 x IV)	40 x 37mm (10 x IV)	40 x 37mm (10 x IV)	32 x 37mm (8 x IV)
Catapults	2	2	2	2	2
Aircraft	4	4	4	4	4
Protection:					
main belt	380mm	380mm	380mm	380mm	380mm
upper belt	220mm	200mm	220mm	220mm	220mm
belt forward	220mm	200mm	220mm	220mm	220mm
forecastle deck	30mm	25mm	20mm	20mm	25mm
upper deck	50mm	50mm	50mm	50mm	140mm
middle deck	180mm	135mm/180mm	180mm	180mm	60mm
lower deck fwd	135mm	200mm	220mm	220mm	220mm
Depth u/w protection	7.5m	not less than 7.0m	7.0–7.5m	7.1–8.1m	7.0–8.2m
Machinery:					
natural draught	N/S	—	N/S	3 x 67,000shp	3 x 67,000shp
forced draught	N/S	3 x 75,000shp	N/S	3 x 77,000shp	3 x 77,000shp
Speed:					
natural draught	—	—	29 knots	28.7 knots	28.5 knots
forced draught	30 knots	30 knots	30 knots	29.5 knots	29.5 knots
Range	6–8,000nm	—	6–8,000nm/14kts	6,150–6,750nm/ 14 knots	6,480nm/14kts

Source: Vasil'ev, 51

Design TsKBS1 November 1936

Displacement: 44,900 tonnes
Length: 251m oa
Beam: 33.1m wl
Horsepower: 180,000shp = 30kts
Armament: 9 x 406mm (3 x III)
12 x 152mm (6 x II)
12 x 100mm (6 x II)
40 x 37mm (10 x IV)

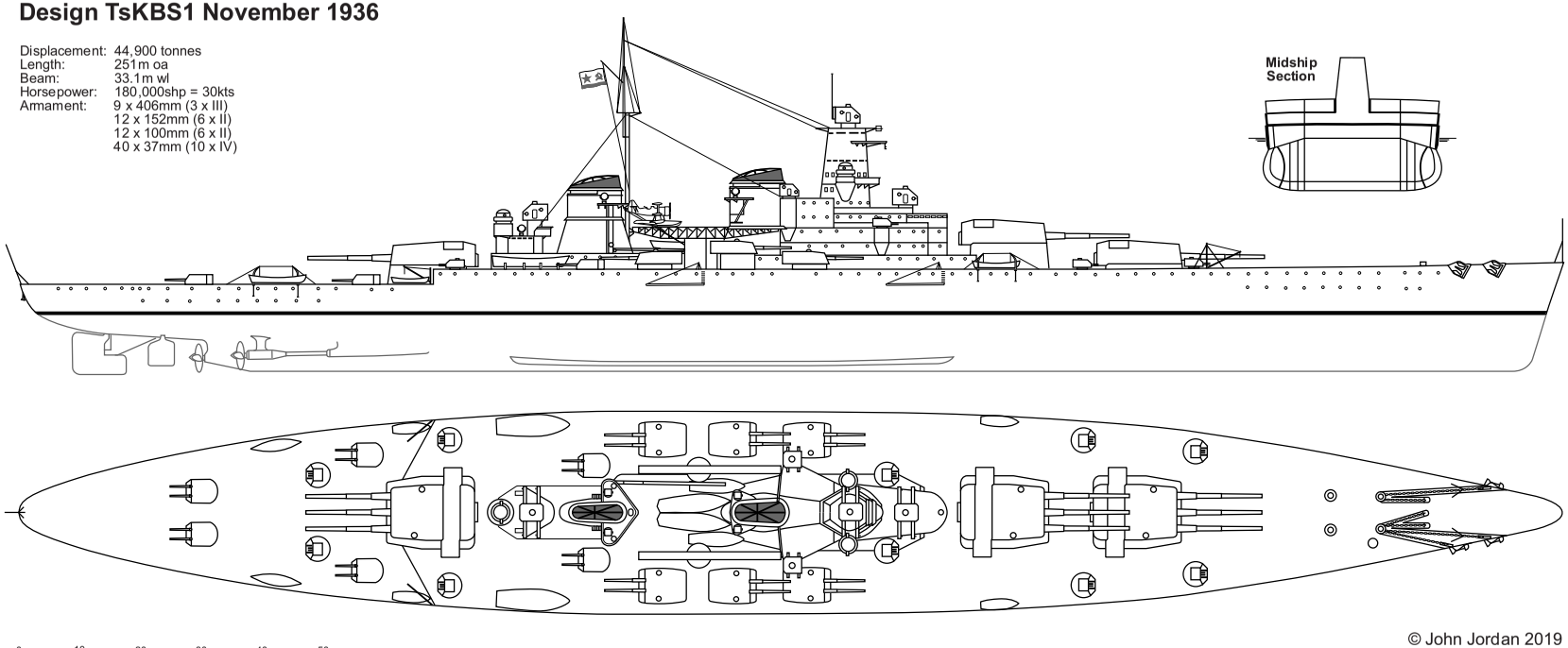
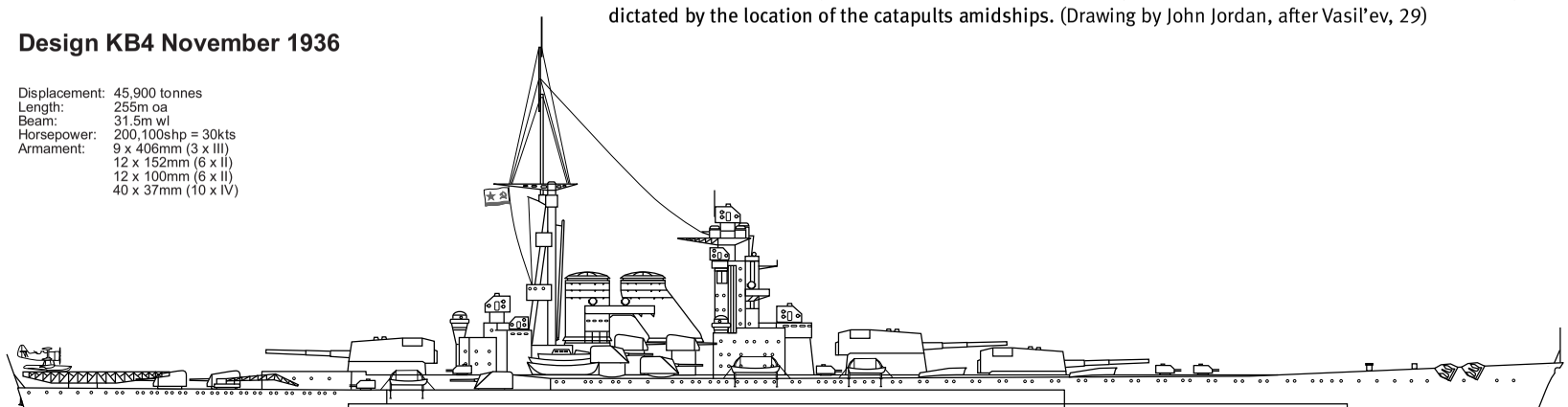


Fig 1: Design bureau TsKBS-1's submission for the Battleship A, November 1936. The cross-section shows the so-called 'Ansaldo' torpedo protection system, with a curved bulkhead. The disposition of the 100mm AA battery is unique, with four twin turrets on the quarterdeck, and two turrets directly abaft the 152mm turrets – an arrangement probably dictated by the location of the catapults amidships. (Drawing by John Jordan, after Vasil'ev, 29)

Design KB4 November 1936

Displacement: 45,900 tonnes
Length: 255m oa
Beam: 31.5m wl
Horsepower: 200,100shp = 30kts
Armament: 9 x 406mm (3 x III)
12 x 152mm (6 x II)
12 x 100mm (6 x II)
40 x 37mm (10 x IV)



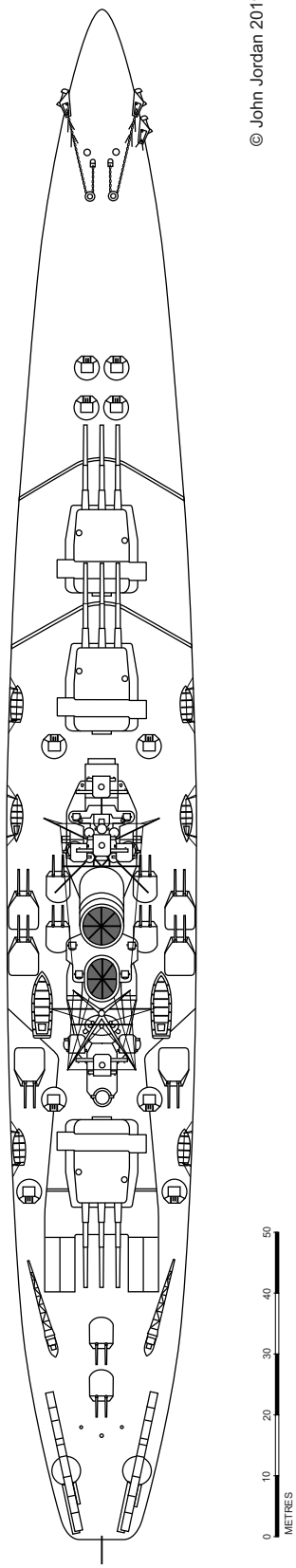


Fig 2: KB-4's winning design in the November 1936 design competition. The backward-curving forward funnel was due to the placement of the forward boiler room directly below the forward superstructure. Several elements of the design, including location of the catapults and a pair of 100mm turrets on the quarterdeck, as well as the hangar arrangements, would be a feature of subsequent KB-4 designs. (Drawing by John Jordan, after Vasil'ev, 22)

submission (Fig 1) had a finer hull form and used Wagner boilers, while the KB-4 version (Figs 2, 3, 4) used three-drum boilers and had a fuller hull form that required more horsepower to achieve the specified speed. A distinctive feature of KB-4's design was the curved forward funnel, similar to that of several Japanese battleships; this was a consequence of the extreme compression of the vitals, which led to the forward boiler room being placed directly under the conning tower, so that its uptakes had to be trunked back. The magazines for the secondary and AA batteries were jammed into narrow compartments outboard of the two forward boiler rooms and an equally narrow compartment sandwiched between the turbines of the wing shafts. The long, unencumbered forecastle made it possible to maintain fine lines despite the full-depth side protection system abreast the forward magazines. KB-4 offered two different versions of underwater protection: the Pugliese system and the 'Ansaldo' system, a multi-bulkhead type that featured a concave main bulkhead that had been used in UP.41. TsKBS-4's design also used the Ansaldo system.

On the whole, both the Navy and shipbuilding industry preferred the KB-4 design, which had been worked out in a number of variants and was considered more developed than TsKBS-1's submission. The latter's design for Battleship B, on the other hand, was considered superior, and from this point onward the two battleship designs would be handled by separate design bureaux and take very different development paths. The smaller battleship was declared 'wrecked' (that is, sabotaged by supposed enemies of the state) in August 1937 and was replaced by Project 64, armed with 356mm guns; by early 1938 it had grown to 48,000 tons, at which point it was cancelled in favour of building more Project 23 ships.

In theory KB-4's design, having won the competition, should have led directly to a technical design that would form the basis for the construction of the ship but, despite being judged the better design, the Navy was far from satisfied. It preferred siting the aviation facilities amidships, it disliked the long bow, which was unarmoured at its forward extremity, it wanted all the reduced armour thicknesses restored to the original specifications, and it demanded heavier deck protection: instead of 135mm with 180mm only over the magazines, it wanted a uniform deck of 180mm over the entire citadel. To accomplish all this the Navy was willing to boost the displacement to 46–47,000 tons. The result of these changes was a revised TTZ, issued on 26 November 1936 (Table 2, col A).

The Navy's new demands placed KB-4 in an impossible position: B G Chilikin, the bureau's chief constructor, argued that to fulfil all the requirements would require a ship of not less than 53,900 tons standard displacement. In an attempt to square the circle, KB-4's designers took the radical step of chopping eight meters off the forward hull. This eliminated the long unprotected bow, but it also led to a blunter lines, so the machinery power had to be boosted to 225,000shp to maintain the required 30-knot speed. KB-4 also concentrated the secondary battery in four triple turrets rather than the specified six twins.

Design KB4 November 1936: GA Plans

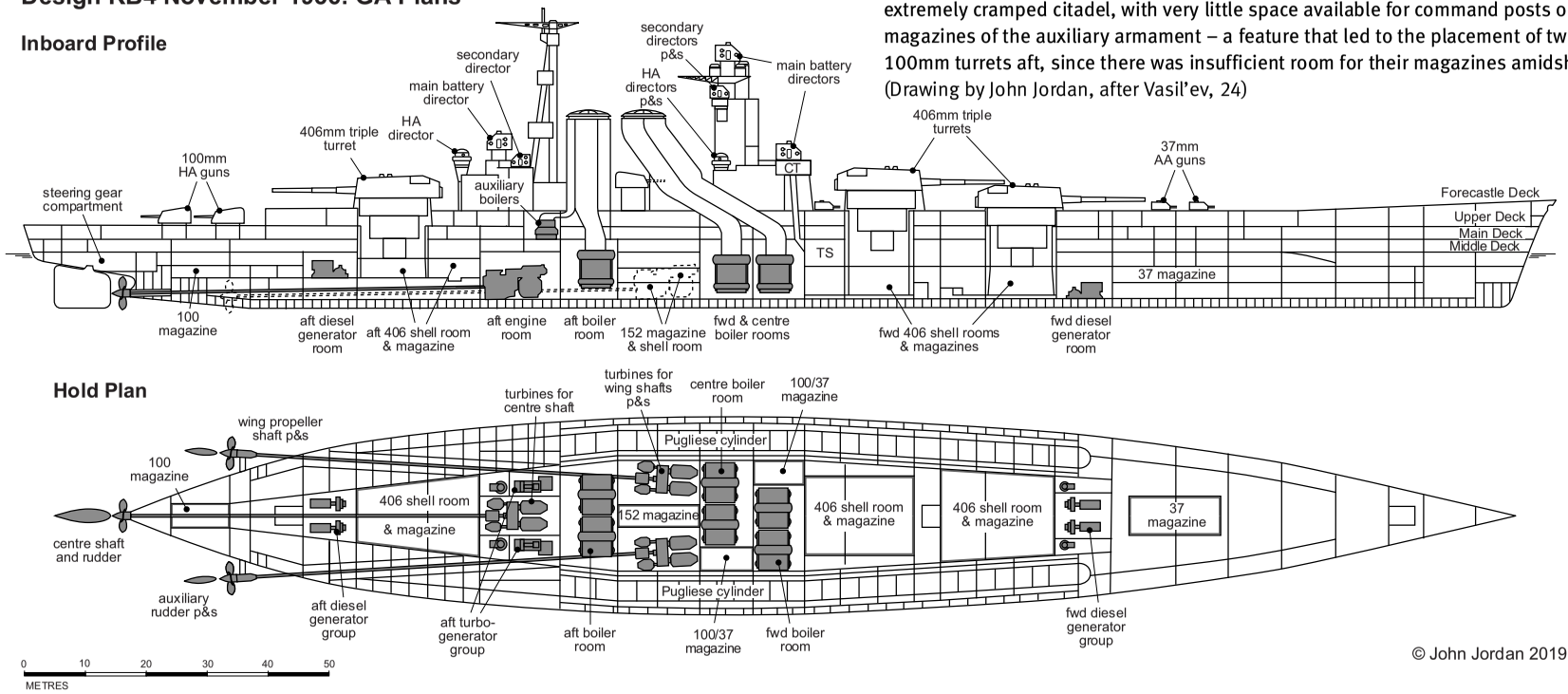
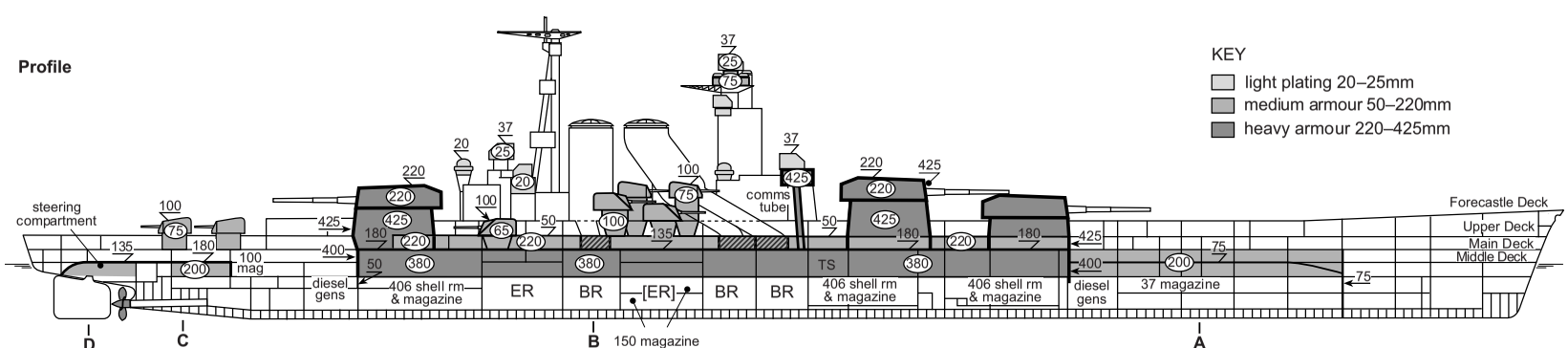


Fig 3: General arrangements of the KB-4 design, November 1936. Note in particular the extremely cramped citadel, with very little space available for command posts or the magazines of the auxiliary armament – a feature that led to the placement of two 100mm turrets aft, since there was insufficient room for their magazines amidships. (Drawing by John Jordan, after Vasil'ev, 24)

Design KB4 November 1936: Protection



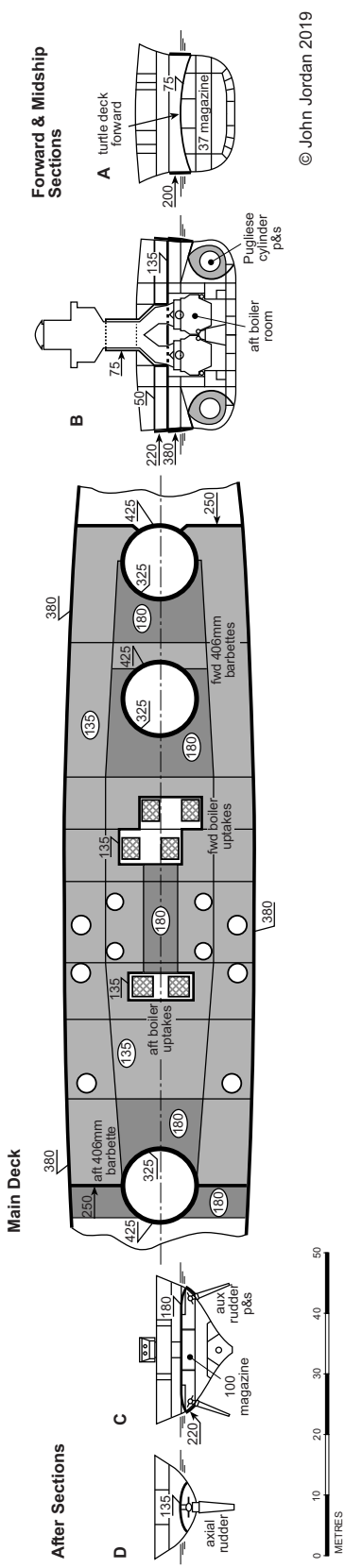
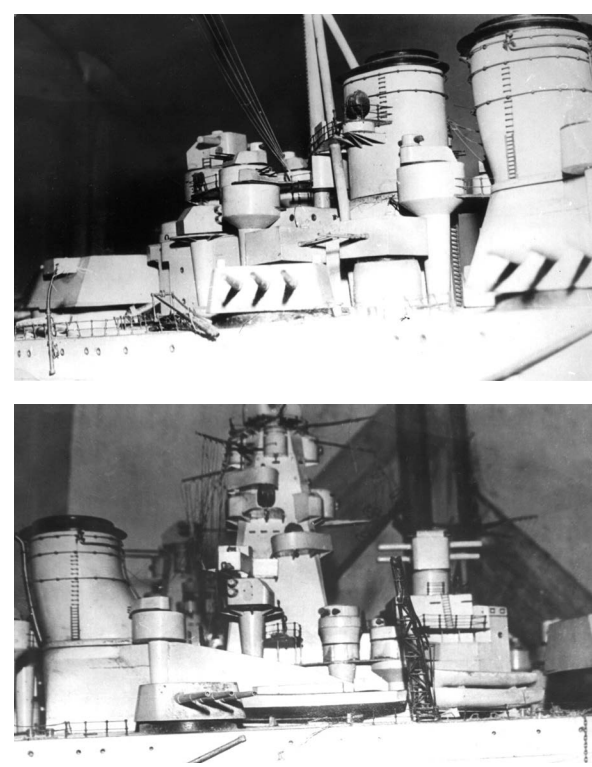


Fig 4: The protection scheme of KB-4's design, November 1936. The sloping sides of the main battery barbettes are curious, as this would tend to improve the penetrating power of incoming shells by making their impact closer to the normal. Note also the relatively long unprotected bow, a feature the Navy wanted eliminated. (Drawing by John Jordan, after Vasil'ev, 26)

And once again it was forced to reduce armour thicknesses: the desired 180mm armour deck went by the board. Despite these measures the displacement came to more than 48,000 tons. Many of the other features of the competition design were retained, including the aviation facilities and the pair of 100mm turrets on the quarterdeck. Long, curved uptakes were still required for the forward boiler rooms (see Fig 5 and Table 2, col B).

In reviewing the progress of the design in April 1937, the Navy asked KB-4 to work out a parallel design limited to 47,000 tons and in strict accordance with the TTZ. This was designated Variant II, the larger design being Variant I. Both variants were presented to the Defence Committee on 4 July 1937, although it is unlikely that Variant II was a complete design. The shipbuilding industry's representatives came expecting a fight with the Navy over the need for more tonnage to meet the requirements, but in the interim the Navy's leadership had come to the same conclusion. Recent reports indicated that both Japan and Germany would soon begin construction of battleships displacing 50–52,000 tons, so the Navy was now more than willing to increase the size of Project 23. As a result, it was soon agreed by all parties that displacement should be 55–57,000 tons. A new TTZ was therefore issued (Table 2, col C), and work began on Variant III.



Two photographs of a model of Variant I. This model was probably used at the 4 July 1937 session of the Defence Committee and shows the arrangements of the superstructure and auxiliary armament. The crude forms of the 152mm and 100mm turrets probably reflect the fact that these mountings had yet to be designed. (Boris Lemachko collection)

Variant I May 1937

Displacement: 48,415 tonnes
Length: 247m oa
Beam: 34.5m wl
Horsepower: 225,000shp = 30kts
Armament: 9 x 406mm (3 x III)
12 x 152mm (4 x III)
12 x 100mm (6 x II)
40 x 37mm (10 x IV)

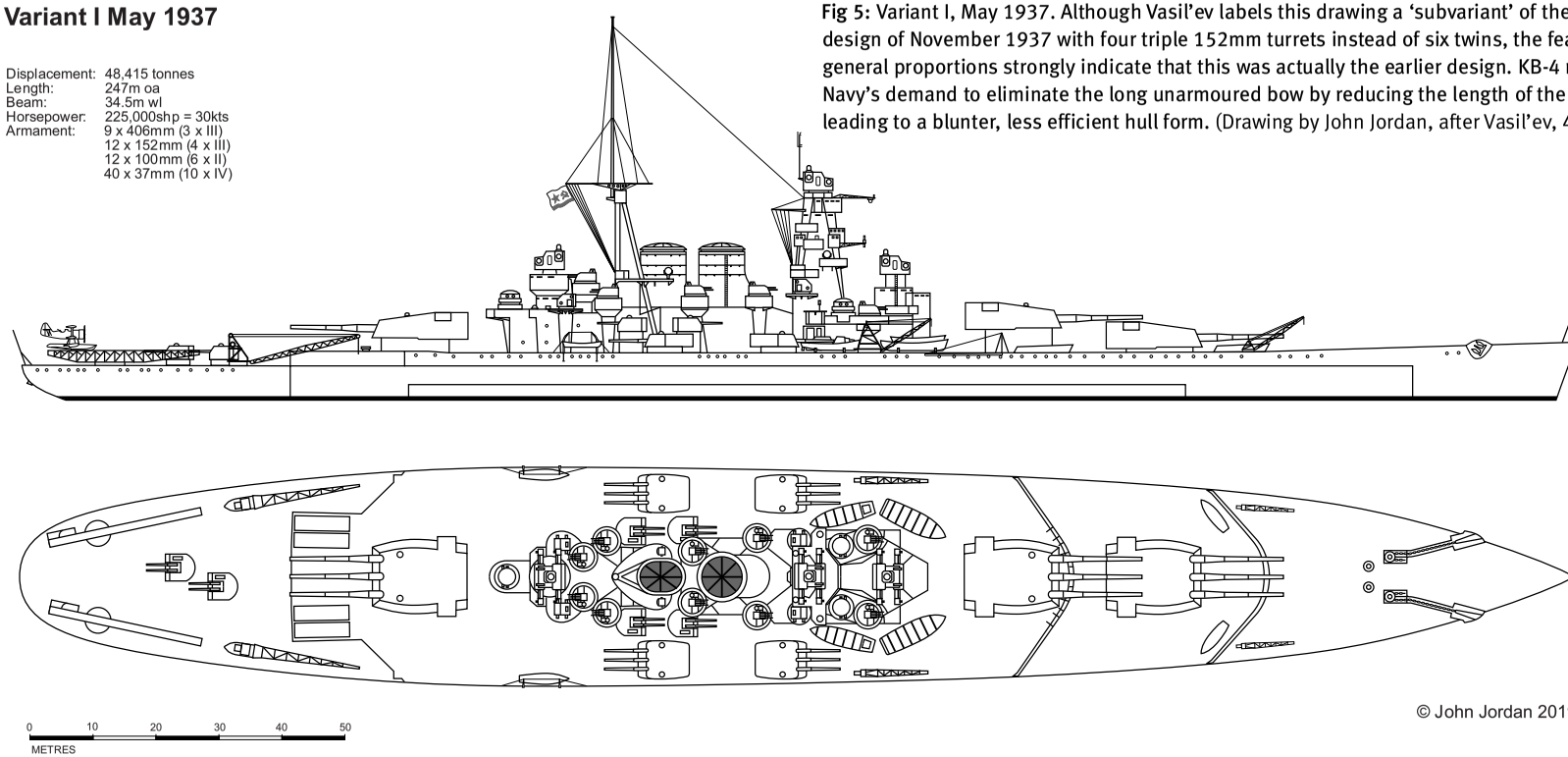
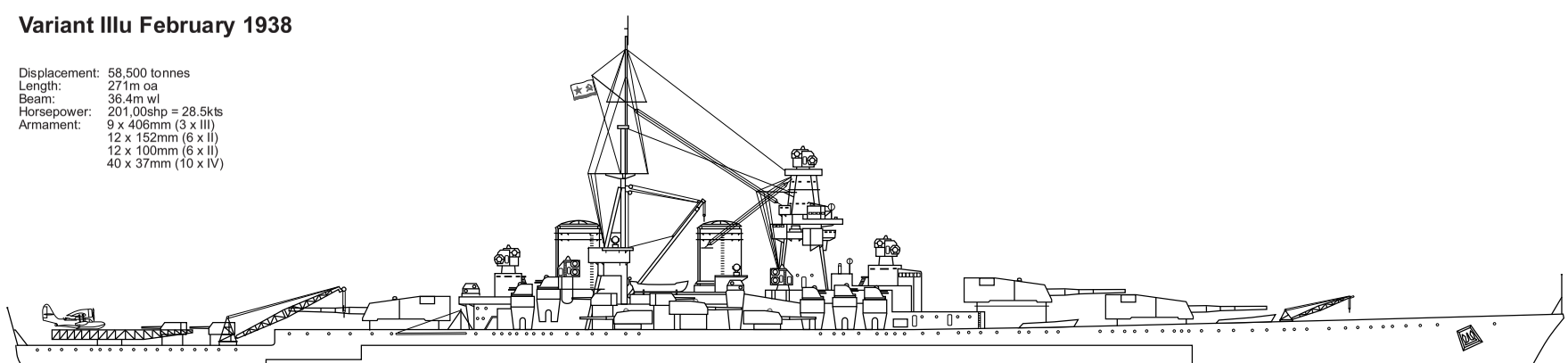


Fig 5: Variant I, May 1937. Although Vasil'ev labels this drawing a 'subvariant' of the Variant III design of November 1937 with four triple 152mm turrets instead of six twins, the features and general proportions strongly indicate that this was actually the earlier design. KB-4 met the Navy's demand to eliminate the long unarmoured bow by reducing the length of the forward hull, leading to a blunter, less efficient hull form. (Drawing by John Jordan, after Vasil'ev, 40)

Variant IIIu February 1938

Displacement: 58,500 tonnes
Length: 271m oa
Beam: 36.4m wl
Horsepower: 201,00shp = 28.5kts
Armament: 9 x 406mm (3 x III)
12 x 152mm (6 x II)
12 x 100mm (6 x II)
40 x 37mm (10 x IV)



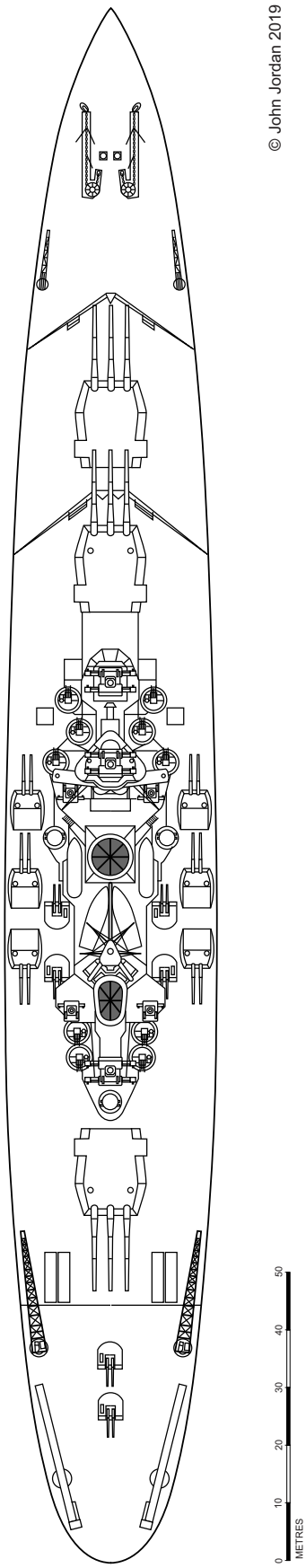


Fig 6: Variant IIIu of February 1938. Many features from KB-4's original November 1936 design are still in evidence – in particular the aviation arrangements and the two 100mm turrets on the quarterdeck. This version still has ten quad 37mm mountings, but two would soon be eliminated to reduce the 'congestion' of the superstructures. (Drawing by John Jordan, after Vasil'ev, 44)

Variants III & IIIu

It was at about this time that an orgy of destruction fuelled by Stalin's paranoia swept through the Navy and industry, further complicating the work of the design bureaux. Both Muklevich of the shipbuilding industry and Orlov of the Navy were arrested and executed; many naval officers and constructors – including the head of KB-4, L S Grauerman, and the Navy's chief technical adviser to the design bureau, E P Libel – were purged. This ongoing slaughter must be kept in mind when evaluating the progress of the battleship design; everyone in industry and the armed forces was working under the constant threat of death or imprisonment in the Gulags.

Nevertheless, the work did continue, and by November 1937 Variant III was completed (see Table 2, col D). Once again, however, the Navy, now headed by M V Viktorov, was unhappy with the design, especially the speed, which had fallen off by about half a knot despite a modest increase in horsepower. There were also concerns about the inordinate length of the wing shafts. This was the result of a rearrangement of the machinery;

A model of Variant IIIu. This 1:100-scale model was shown at the 27–28 February 1938 meeting of the Defence Committee. Several photographs of this model were published in the late 1980s and early '90s, leading to the erroneous conclusion that it represented the final configuration of the design.
(Boris Lemachko collection)

the positions of the boiler and engines rooms had been reversed, so that the foremost machinery compartments were the engine rooms for the wing turbines. This unusual arrangement reduced the length of the boiler uptakes, but the shaft runs were thereby increased.

Moreover, the Navy now demanded a major change to the horizontal protection. Full-scale bombing trials carried out in the Black Sea demonstrated that 500kg high-explosive (HE) bombs would penetrate both the 40mm forecastle deck and the 50mm upper deck before exploding against the 180mm main deck; armour fragments would then spall off into the vital spaces below. The Navy therefore wanted to move the heavy armour deck to the upper deck and turn the main deck into a thin splinter deck. This meant the 220mm upper belt would have to be replaced with an upward extension of the 380mm main belt, increasing its height from 3.7m to 6.4m (a similar change had been made during the preliminary design of the *King George V* class[9]).

This and other changes were incorporated into the next design iteration, Variant IIIu ('u' for *uluchshennyi*, 'improved'; see Fig 6 and Table 2, col E), which was presented to the Defence Committee at a meeting on 27–28 February 1938. The shipbuilding industry's main spokesman was B G Chilikin, the lead constructor, while the Navy's representative was its deputy commissar, I S Isakov. There was broad agreement that the design could be taken as a basis for starting construction, but there were several sharp disagreements between the industry and the Navy over details. The most bitter argument revolved around industry's desire to eliminate the two 100mm turrets on the quarterdeck to reduce a trim by the stern; deleting these turrets along with their heavily-protected magazines was seen as the best way to resolve – or at least mitigate – the problem without reworking the entire design. Isakov argued for the retention of these turrets, but the Defence Committee eventually approved their deletion.

Another disappointment involved the Navy's hopes to move the aviation facilities amidships, which were stymied by the 'congestion' there – a problem that had already forced the Navy to agree to a reduction in the number of quad 37mm mounts from ten to eight. To some degree this congestion was caused by an excessive concern about the blast effects of the 406mm guns, which led to the 152mm, 100mm, and 37mm batteries being squeezed into a small area.

As usual, Stalin had the last word:

> I V Stalin summed things up; he stood up from his armchair and paced around the hall, calmly and persuasively expressing his thoughts on the questions raised during the course of the discussion. He proposed approving the technical design as presented … Regarding the Navy's demand for the additional gun turrets, he proposed to the People's Commissar of the Navy that this question be reviewed in two months …[10]

And that settled matters for the moment.

The Defence Committee had largely sided with the shipbuilding industry at this meeting, but only a week later, on 7 March, it approved a series of changes recommended by the Navy. The most consequential of these was a change to the deck armour; instead of a 140mm upper deck with a 60mm splinter deck below, the upper deck was to be 155mm and the splinter deck reduced to 50mm; other more or less minor adjustments to the armour protection made the change weight-neutral. Another question settled was the underwater protection: although tests to determine the most effective method were still in progress, the decision was made to use the Pugliese system in order to prevent further delays.

Two months later the Navy faced another disappointment when trials with a self-propelled 1:10-scale model of the Project 23 hull revealed that the maximum speed of the ship would be only 27.5 knots at normal draught, and 28.5 knots when the machinery was forced. The poor performance was blamed on the propeller design, which had been selected to avoid the cavitation problems that had plagued the destroyer leader *Leningrad*.

By now the displacement of the design stood at 57,576 long tons (58,500 tonnes), whereas the Anglo-Soviet naval agreement, which had finally been signed on 17 July 1937, specified a 35,000-ton limit. However, on 6 July 1938 a protocol to the agreement permitted the signatories to build battleships of up to 45,000 tons, reflecting the recent invocation of the 'escalator' clause of the Second London Naval Treaty. Two days later, the Soviet government informed Great Britain of the forthcoming keel-laying of the lead ship of the class, *Sovetskii Soiuz*; while the ship's armament was accurately reported, her displacement was given as only 44,190 tons to maintain the appearance of complying with the treaty's terms.[11] Although the final design was still far from ready, the ship was laid down at the Ordzhonikidze Works on 15 July.

The Final Design

The Defence Committee had decreed that the design was to be completed by 1 June 1938, but this had to be pushed back to 1 September. That deadline also passed; the design was finally submitted only on 13 October (see Fig 7 and Table 3), and even then it was still not complete – the fire control systems were still under development, as were the stabilised AA directors. KB-4, which had earlier been so concerned about the ship's trim by the stern that it had insisted on deleting the two 100mm turrets on the quarterdeck, now made things worse by shifting the after main-battery turret 6.39m towards the stern. This improved the arcs of fire of the main battery and allowed the secondary and heavy AA batteries to be better spaced out, but the change was not sufficient to make room for the aviation facilities amidships.

KB-4 also recommended a change in the belt armour. The bureau noted that, while the protection scheme was based on engaging a target 40 to 50 degrees off the bow, on these bearings the enemy's shells would strike the belt

Table 3: **Final Technical Design, 1938–1941**[1]

Displacement:	
standard	59,150 tonnes design; 60,190 tonnes actual (est)[2]
normal	62,155 tonnes design
full load	65,150 tonnes design; 67,370 tonnes actual (est)[2]
Length	269.4m oa, 260.0m wl
Beam	38.9m max, 36.4m wl
Draft	9.36m standard, 9.78m normal, 10.10m full load
Armament:	
main guns	9 x 406mm (3 x III); 100rpg
secondary guns	12 x 152mm (6 x II); 190rpg
HA guns	8 x 100mm (4 x II); 300rpg
light AA	40 x 37mm (10 x IV); 1800rpg
Catapults	1
Aircraft	4 x KOR-2
Protection:	
main belt	420–406–390–375–380mm at 5°
upper belt	180mm
belt forward	220mm
transverse b/hds	285–230mm fwd, 365–180mm aft
forecastle deck	25mm
upper deck	155mm
middle deck	50mm
lower deck fwd	100mm
406mm turrets	495mm faces, 230mm sides, 410mm backs, 230mm roof
406mm barbettes	425mm
152mm turrets	100mm faces, 65mm sides, 65mm backs, 100 roofs
152mm barbettes	100mm
100mm turrets	65mm faces, sides and backs, 100mm roofs
37mm turrets	25mm faces, sides, backs, roofs
U/w protection system	Pugliese & 'American', 7.0–8.2m deep
Machinery:	
boilers	six three-drum type
engines	three sets geared turbines
horsepower	201,000shp (231,000shp forced)
speed	28 knots (29 knots forced)
Endurance:	
normal load	oil 5,280 tonnes = 5,960/6,300nm at 14.5kts (winter/summer)
deep load	oil 6,440 tonnes = 7,260/7680nm at 14.5kts (winter/summer)
Complement	1,784

Notes:
1 The 'final' technical design was approved in October 1938, but changes continued through 1941; the data here reflect the status of the design as of 1941.
2 The estimated displacements were calculated by A M Vasil'ev based on changes to the design as of 1941.

Source: Vasil'ev, 51, 81, 87, 89, 90.

at angles closer and closer to the normal as the hull narrowed forward. In fact, calculations indicated that the 380mm belt could be penetrated out to 102 cables (20,400 yards) abreast the forward turret, whereas over the machinery it was proof down to 75 cables (15,000 yards). The bureau therefore proposed varying the thickness of the belt, decreasing it over the machinery to 375mm and increasing it over the forward magazines; over the after magazines the original thickness of 380mm was retained. The weight of armour would remain exactly the same, but it would provide roughly equal belt protection along its entire length.

KB-4 also raised an issue with the rudder arrangements. From its earliest stages the design had featured three rudders – a large centre rudder and two smaller side rudders, all positioned in the wake of one or other of the propellers. The centre rudder was farthest aft and its steering gear had only light splinter protection, whereas the gear for the two side rudders was under heavy armour. Tests with the 1:10 scale model of the battleship's hull showed that if the centre rudder became jammed, the side rudders could not overcome its effects, and the ship would turn in circles. KB-4 therefore recommended deleting the centre rudder; it was estimated this

Sovetskii Soiuz: Final Design July 1939

Displacement: 59,150 tonnes
Length: 269.4m oa
Beam: 36.4m wl
Horsepower: 201,000shp = 27.5kts
Armament: 9 x 406mm (3 x III)
12 x 152mm (6 x II)
8 x 100mm (4 x II)
36 x 37mm (8 x IV)

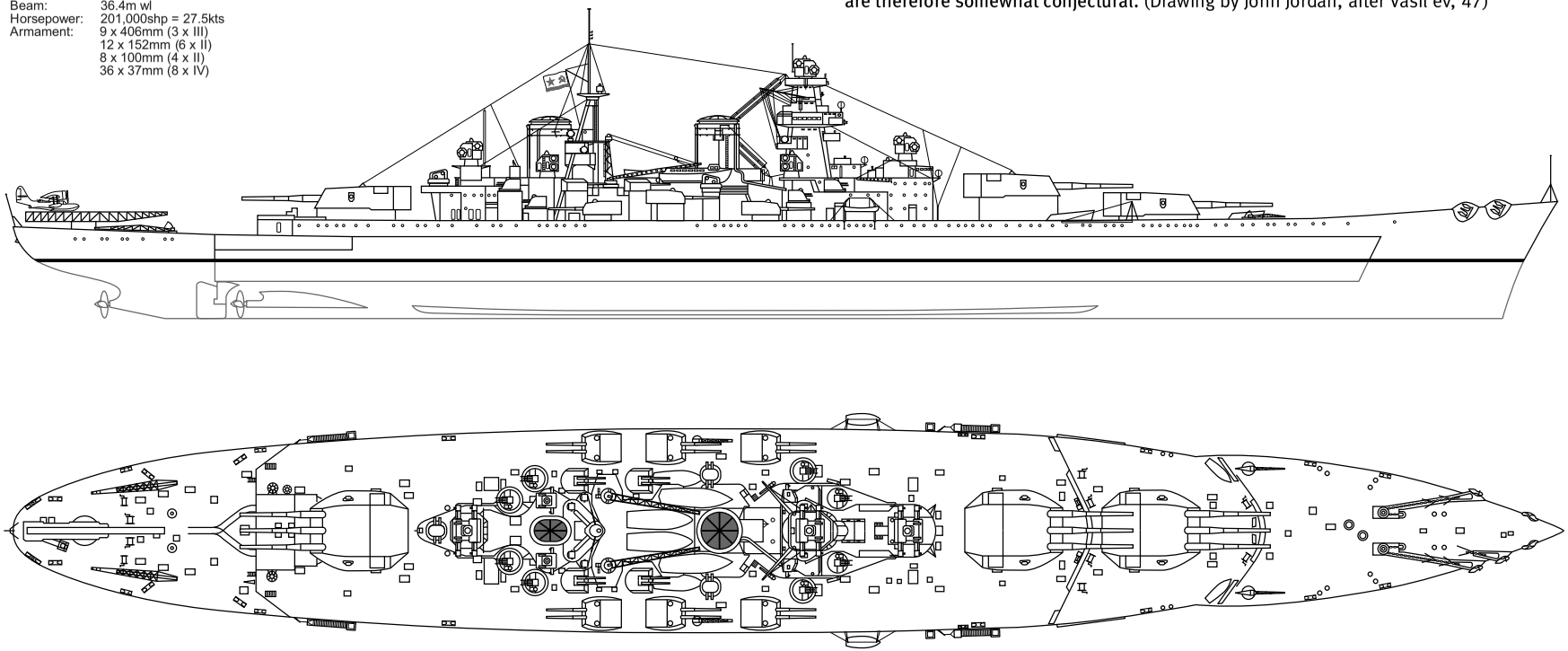


Fig 7: The technical design as of July 1939. The ship has almost reached its final form, the only changes still to be implemented being the restoration of two twin 100mm mountings – now in splinter shields rather than turrets – on the quarterdeck, and the addition of wooden planking on the forecastle deck. The rudder and propeller arrangements are based on written descriptions rather than drawings, and are therefore somewhat conjectural. (Drawing by John Jordan, after Vasil'ev, 47)

would increase the ship's turning radius from 3.18 ship-lengths to 4, but subsequent trials showed that the actual turning radius at full speed would be 4.5 ship-lengths.

The Navy expressed its views on KB-4's design and proposals in a report dated 22 November 1938. It accepted the graduated belt armour scheme, but instead of arranging the plates horizontally in two strakes, as advocated by the shipbuilding industry, it wanted them arranged vertically in a single strake. Regarding the trim by the stern, it noted that the elimination of the centre rudder and its armour protection would help, and it was willing to trade one of the two catapults for two 100mm mountings in splinter shields (rather than enclosed mountings), with only fifty rounds per gun, stowed in ready-use lockers (rather than in a heavily-protected magazine). But the Navy was very unhappy that the ship's speed was now 27.5 knots at natural draught rather than 28.5 knots, and demanded that it be increased to at least 28 knots.

By the summer of 1939 KB-4 had incorporated most of these changes into the design, even managing to increase the speed by half a knot thanks to a new propeller design. But it adamantly refused to add the two 100mm mounts on the quarterdeck. This 'final' technical design was approved by the Defence Committee on 13 July 1939.

However, this was not the end of the design changes. The new Navy Commissar, Admiral N G Kuznetsov, who had been appointed in April 1939 – his three immediate predecessors had been purged in succession – was determined to get back those 100mm guns on the quarterdeck, and finally on 14 January 1941 the Defence Committee agreed. How they were to be sited, given the single catapult on the centreline, is not clear. Another change Kuznetsov insisted upon was that the weather decks have wood planking, which had not originally been included in order to save weight. However, Kuznetsov argued that it was essential for habitability, and in February 1941 his proposal was adopted at a cost of an additional 243 tons of weight; the planking was to be removed in wartime. Given this and other additions, the leading historian of the design estimates that by 1941 the ship's displacement would have amounted to 60,190 tons standard, 67,370 tons full load.[12]

General Features

The hull was of riveted construction, and the framing was of the 'mixed' type: within the citadel it ran longitudinally, but at the bow and stern it was laid transversely. The frame spacing within the citadel was 1.42m (although it was reduced to 0.71m in places bearing heavy loads), while at the bow and stern it was 0.9m. The hull was divided into 33 main watertight compartments by transverse bulkheads. The metacentric height of the final design was 3.11m at standard displacement, 3.31m at normal load, and 3.49m at full load. For weights, see Table 4.

The hull form was very full, with a block coefficient of 0.657 – for comparison, *Yamato's* was 0.596. This resulted from the requirement to maintain a deep underwater protection system abreast the forward magazines, but it meant that very high power was required to achieve even modest speeds. This was further exacerbated by the choice of a three-shaft propulsion plant, which led to very high shaft loading and a loss of propulsive efficiency.

The cost per ship was estimated at 1.18 billion rubles, but one authority has suggested that the actual cost would have been 1.5–1.8 billion each, based on cost overruns on other Soviet ships of the period.[13]

Armament

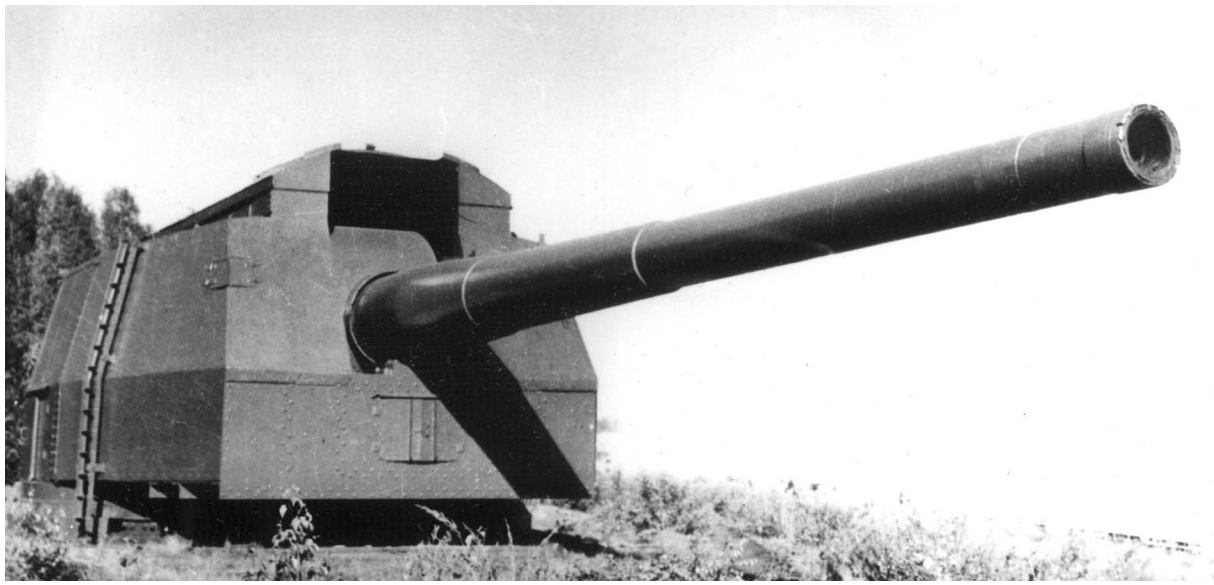
The 406mm guns were one of the few unqualified successes in the design of the ships, with the first gun passing its trials at the proving ground near Leningrad in 1940 (for gun data, see Table 5; for the layout of the various control positions, see Fig 8). The guns were to have elevation limits of -2° to +45° with a fixed loading angle of +6 degrees. This led to a varying rate of fire, depending on the angle of elevation: 2.5 rounds per

Table 4: **Weights**

Design	KB-4	Variant IIIu	Tech Design	Final Tech Design
Date	Oct 1936	Feb 1938	Nov 1938	June 1939
Hull	14,969 tonnes	18,144 tonnes	19,385 tonnes	20,188 tonnes
Armour	17,165 tonnes	23,499 tonnes	23,306 tonnes	23,306 tonnes
Armament	8,121 tonnes	11,468 tonnes[1]	8,653 tonnes	8,547 tonnes
Ammunition	1,758 tonnes	—	1,953 tonnes	1,920 tonnes
Machinery	2,876 tonnes	3,517 tonnes	3,742 tonnes	3,727 tonnes
Crew & supplies	590 tonnes	659 tonnes	642 tonnes	642 tonnes
Margin	451 tonnes	1,200 tonnes	820 tonnes	820 tonnes
Standard displacement	45,930 tonnes	58,420 tonnes	58,500 tonnes	59,150 tonnes
Fuel, water, lubricants	5,100 tonnes	6,042 tonnes	6,000 tonnes	6,000 tonnes
Full load displacement	51,030 tonnes	64,460 tonnes	64,500 tonnes	65,150 tonnes

Note:
1 Includes ammunition.

Source: Vasil'ev, 52.



The 406mm gun on a test mounting at the proving grounds near Leningrad. Trials of the first gun were carried out 6 July to 2 October 1940 and were deemed successful. The trials gun was subsequently replaced by another, and from 29 August 1941 this gun was used to bombard German positions during the siege of Leningrad. A total of twelve barrels were manufactured by the Barrikada Works in Stalingrad. (Boris Lemachko collection)

minute (rpm) up to 14 degrees, slowing to 1.73rpm at higher angles. The turrets weighed 2,087 tonnes and rotated on 150 ball bearings; there were also 204 vertical rollers to receive the horizontal thrust when the guns fired. The ammunition outfit was 100 rounds per gun (rpg). The main battery was controlled by three command-rangefinder posts (*komandno-dalnomernye posty*, or KDP, equivalent to the Royal Navy's director control tower), each of which was equipped with two 8-metre stereoscopic rangefinders – one for measuring the range to the target, the other for ranging on the ship's own shell splashes (scartometry). In addition, the main-battery turrets were each fitted with 12-metre rangefinders.

The 152mm/57 guns had elevation limits of -5° to +45°, with a fixed loading angle of +8 degrees. Rate of fire varied due to the fixed loading angle, with the

Table 5: **Guns of Project 23**

Mounting designation	**MK-1**	**MK-4**	**MZ-14/B-54***	**46-K**
Gun designation	B-37	B-50	B-54	—
Calibre	406.4mm/50	152.4mm/57	100mm/56	37mm/67.5
Barrel length	20,720mm	8,950mm	5,795mm	2,510mm
Barrel weight	136,690kg	11,999kg	2,503kg	65kg
Barrel life	300 rounds	450 rounds	750 rounds	2,000–3,500 rounds
Elevation limits	–2° to +45°	–5° to +45°	–8° to +85°	–10° to +85°
Rate of fire	1.7–2.5rpm	4.8–7.5rpm	16rpm	160–180rpm
Crew (per mounting)	100	32	17/18[1]	13
Projectiles and performance				
Weight of projectile	1,108kg	55kg	15.8kg	0.76kg
Propellant charge	309.4kg	35kg	30kg[2]	1.5kg[2]
Muzzle velocity	830m/sec	950m/sec	900m/s	915m/sec
Maximum range	45,670m	30,210m	22,000m	5,000m

Notes:
1 Turret/shielded mountings.
2 Weight of cartridge.

Sources:
Vasil'ev, 62.
A V Platonov, S V Aprelev and D N Siniaev, *Sovetskie boevye korabli 1941–1945 gg*, vol IV, Tsitadel' (St Petersburg, 1997), 43, 45, 48, 50.
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