= Lion @-@ class battleship =

The Lion @-@ class battleships were a class of six fast battleships designed for the Royal Navy in the late 1930s . They were a larger , improved version of the King George V class with 16 @-@ inch (406 mm) guns . Only two ships were laid down before World War II began in September 1939 and a third was ordered during the war , but their construction was suspended shortly afterwards . Their design changed several times in response to the removal of treaty restrictions on size and in light of war experience . None of the other ships planned were laid down , although there was a proposal to modify one of the suspended ships into a hybrid battleship / aircraft carrier with two 16 @-@ inch gun turrets and a flight deck . The two ships already begun were scrapped after the end of the war .

= = Design and description = =

The choice of 14 @-@ inch (356 mm) gun and the mix of quadruple and twin turrets for the main battery of the King George Vs had been dictated by the Second London Naval Treaty , which limited battleships to 35 @,@ 000 long tons (36 @,@ 000 t) standard displacement and a main calibre of 14 inches . However , when the Japanese Government refused to agree to its terms , the maximum calibre allowed reverted to 16 inches in April 1937 . The Board of Admiralty then began preliminary design work on a 35 @,@ 000 @-@ ton ship armed with 16 @-@ inch guns and they were promising enough that the Director of Naval Construction (DNC) was ordered to further investigate such designs , providing for several aircraft as well . To save design time , many of the features of the King George Vs were incorporated in the new design , but the limited size of the ship was a real challenge for the designers . The increased weight of the main armament was compensated for by a slight reduction in the overall weight of armour and the elimination of two twin 5 @.@ 25 @-@ inch (133 mm) gun turrets .

The designer 's issues were made much easier on 31 March 1938 when the signatories of the Treaty invoked its escalation clause because the Japanese refused to provide any information about their battleship construction programme and the signatories feared that their new ships could be outclassed by the new Japanese battleships . The new limit was 45 @,@ 000 long tons (46 @,@ 000 t) at " American insistence " , but the Admiralty decided to limit themselves to 40 @,@ 000 long tons (41 @,@ 000 t) and nine 16 @-@ inch guns on cost grounds and that larger vessels would be unable to dock at Rosyth or Portsmouth . A new design was prepared with more armour , more powerful machinery , the two twin 5 @.@ 25 @-@ inch gun turrets restored , and four aircraft added . The Admiralty approved this design on 15 December and bids were solicited very shortly afterwards .

= = = 1938 design = = =

The 1938 version of the Lion class had an overall length of 785 feet (239 @.@ 3 m) , a beam of 105 feet (32 @.@ 0 m) , and a maximum draught of 33 feet 6 inches (10 @.@ 2 m) . They displaced 40 @,@ 550 long tons (41 @,@ 200 t) at standard load and 46 @,@ 400 long tons (47 @,@ 100 t) at deep load . The appearance of the Lions closely resembled that of the KGVs , but with a transom stern to improve steaming efficiency at high speed .

In the interests of saving time , the four @-@ shaft unit machinery design from the King George Vs was duplicated with alternating boiler and engine rooms . The Lion @-@ class ships had four sets of single @-@ reduction geared Parsons steam turbines housed in separate engine rooms . Each set consisted of one high @-@ pressure and one low @-@ pressure turbine driving one propeller shaft . They were designed to produce a total of 130 @,@ 000 shaft horsepower (97 @,@ 000 kW) at overload condition and a speed of 30 knots (56 km / h ; 35 mph) . The turbines were powered by eight Admiralty @-@ type three @-@ drum water @-@ tube boilers in four boiler rooms at a working pressure of 400 psi (2 @,@ 758 kPa ; 28 kgf / cm2) and temperature of 700 ° F (371 ° C) . The turbines and boilers could be cross @-@ connected in an emergency . The ships were designed to carry 3 @,@ 720 long tons (3 @,@ 780 t) of fuel oil . Their maximum estimated range

was 14 @,@ 000 nautical miles (26 @,@ 000 km ; 16 @,@ 000 mi) at a speed of 10 knots (19 km / h ; 12 mph) . They were equipped with six 330 @-@ kilowatt (440 hp) turbogenerators and two 330 @-@ kW diesel generators that supplied the common ring main at 220 volts .

The Lion @-@ class ships ' main armament consisted of nine 45 @-@ calibre 16 @-@ inch guns of a new design in three triple , hydraulically powered gun turrets designated ' A ' , ' B ' , and ' Y ' from bow to stern . The maximum elevation of the turrets was increased to + 40 ° although the guns were loaded at + 5 ° . They fired 2 @,@ 375 @-@ pound (1 @,@ 077 kg) projectiles at a muzzle velocity of 2 @,@ 483 ft / s (757 m / s) ; this provided a maximum range of 40 @,@ 560 yards (37 @,@ 088 m) . Their rate of fire was two rounds per minute . The ships carried 100 shells per gun . The secondary armament consisted of sixteen 45 @-@ calibre QF 5 @.@ 25 @-@ inch Mk I dual purpose guns in eight twin gun mounts . They had a maximum depression of ? 5 ° and a maximum elevation of + 70 ° . They fired an 80 @-@ pound (36 kg) high @-@ explosive shell at a muzzle velocity of 2 @,@ 672 ft / s (814 m / s) . Their normal rate of fire was about 7 ? 8 rounds per minute . At maximum elevation , the guns had a maximum range of 24 @,@ 070 yards (22 @,@ 010 m) . 400 rounds were provided for each gun . Short @-@ range air defence was provided by 48 QF 2 @-@ pounder guns in six octuple mountings . The 2 @-@ pounder gun fired a 40 @-@ millimetre (1 @.@ 6 in) 1 @.@ 684 @-@ pound (0 @.@ 764 kg) shell at a muzzle velocity of 2 @,@ 400 ft / s (730 m / s) to a distance of 6 @,@ 800 yards (6 @,@ 200 m) . The gun 's rate of fire was approximately 96 ? 98 rounds per minute . 1800 rounds per gun were carried by the ships .

Their armour scheme was virtually identical to that of the King George V class . The waterline belt was composed of Krupp cemented armour (KCA) 15 inches (381 mm) thick and was 433 feet (132 @.@ 0 m) long . The main portion of the belt was 15 feet (4 @.@ 6 m) high , but a lower strake , 8 feet 3 inches (2 @.@ 5 m) high , extended an additional 40 feet (12 @.@ 2 m) past the ends of the armoured citadel . It tapered vertically from 15 inches in thickness to 5 @.@ 5 inches (140 mm) at the bottom edge of the belt , while the plates at the end of the belt were only 11 inches (279 mm) thick at the top . Transverse bulkheads 10 ? 12 inches (254 ? 305 mm) thick closed off each end of the central citadel . At the aft end of the steering gear compartment was a 4 @-@ inch (100 mm) transverse bulkhead . The KCA face @-@ plates of the main gun turrets were 15 inches thick and their roofs 6 @-@ inch (152 mm) non @-@ cemented armour plates . Their sides remained 7 ? 10 inches (180 ? 250 mm) in thickness . The barbettes for the 16 @-@ inch guns were 15 inches thick on the sides , but tapered to 12 ? 13 @.@ 5 inches (305 ? 343 mm) closer to the centreline of the ship .

Intended to resist the impact of a 1 @,@ 000 @-@ pound (450 kg) armour @-@ piercing bomb dropped from a height of 14 @,@ 000 feet (4 @,@ 300 m) , the Lions ' deck protection was identical to that of the King George V class . It consisted of 6 @-@ inch (152 mm) non @-@ cemented armour over the magazines that reduced to 5 inches (127 mm) over the machinery spaces . The armour continued forward and aft of the citadel at the lower @-@ deck level . Forward it tapered in steps from five inches down to 2 @.@ 5 inches (64 mm) near the bow . Aft , it protected the steering gear and propeller shafts with 4 @.@ 5 ? 5 inches (114 ? 127 mm) of armour . Unlike the Germans , French and Americans , the British no longer believed that heavy armour for the conning tower served any real purpose given that the chance of hitting the conning tower was very small and protected the forward conning tower with only 3 ? 4 @.@ 5 inches (76 ? 114 mm) of armour .

The underwater protection , also virtually identical to that of the King George Vs , consisted of a three @-@ layer system of voids and liquid @-@ filled compartments meant to absorb the energy of an underwater explosion . It was bounded on the inside by the 1 @.@ 75 @-@ inch (44 mm) torpedo bulkhead . Both of the inner and outer voids were fitted with pumps to flood them with water to level the ship (counter @-@ flood) in case she began to list . Over the length of the citadel , this system was found to be proof against 1 @,@ 000 lb (450 kg) of TNT during full @-@ scale trials . The Lion @-@ class ships had a double bottom with a depth of 4 feet (1 @.@ 2 m) .

= = = 1942 design = = =

Construction was suspended shortly after the war began and the Admiralty took advantage of the time to refine the design in light of war experience in late 1941 . The beam was increased to the maximum width of the locks of the Panama Canal to increase the depth and effectiveness of ship 's torpedo protection system , and almost 1 @,@ 100 long tons (1 @,@ 100 t) of fuel oil were added to increase the ship 's endurance . The requirement that ' A ' turret had to be able to fire directly ahead at 0 ° elevation was rescinded as it radically reduced freeboard forward and caused the King George Vs to take a lot of water over the bow in head seas . To partially compensate for the additional weight , the belt armour was reduced in thickness by 1 inch (25 mm) except over the magazines , and the aircraft and their facilities were removed . The space in the superstructure freed up by these changes was used to increase the light anti @-@ aircraft armament to nine octuple and one quadruple 2 @-@ pounder mounts .

The overall length of the Lion class increased to 793 feet (241 @.@ 7 m) and the beam to 108 feet (32 @.@ 9 m) . The displacement grew to 42 @,@ 550 long tons (43 @,@ 230 t) at standard load and 47 @,@ 650 long tons (48 @,@ 410 t) at deep load . No changes were made to the propulsion machinery , but the speed decreased to 28 @.@ 25 knots (52 @.@ 32 km / h ; 32 @.@ 51 mph) because of the greater displacement . The 4 @,@ 800 long tons (4 @,@ 900 t) of fuel increased their endurance to an estimated maximum of 16 @,@ 500 nautical miles (30 @,@ 600 km ; 19 @,@ 000 mi) at a speed of 10 knots . The freeboard forward was increased by nearly 9 feet (2 @.@ 7 m) , and the radar suite was increased to match that of the battleship Vanguard , then under construction . Because the cruiser Belfast lost all steam power when she struck a mine early in the war , two diesel generators were substituted for two turbo @-@ generators . The additional beam was used to increase the depth of the torpedo protection system amidships from 13 @.@ 25 feet (4 @.@ 0 m) to 15 feet (4 @.@ 6 m) . The ships ' crew was estimated at 1750 officers and men .

= = = 1944 design = = =

Another attempt was started in February 1944 by the DNC to incorporate wartime lessons and create a cutting edge design , but he soon concluded that " the power of modern weapons had increased so much that ever @-@ increasing armour and torpedo protection was required until it became incompatible with the limited offensive power of the ship . " No effort was made to investigate the torpedo protection system , nor were their characteristics finalized . Naval historians William Garzke and Robert Dulin speculate that the ships might have been 830 feet (253 @.@ 0 m) long , with a beam of 115 feet (35 @.@ 1 m) , and a draught of 35 feet (10 @.@ 7 m) . They might have displaced about 56 @,@ 500 long tons (57 @,@ 400 t) . Estimated endurance was 8600nm with a clean hull . They would have used an improved Mk IV version of the 16 @-@ inch gun in a new Mk III turret that fired a heavier shell at a marginally lower velocity , mounted in three triple turrets . Additionally , they would carry twelve twin QF 4 @.@ 5 inch Mk V guns for secondary armament and nine sextuple Bofors plus an undetermined number of 20mm Oerlikons for anti @-@ aircraft protection .

When it became clear the original 1944 ' Design A ' pushed beyond the technologically feasible , it was abandoned in favour of a simpler modification of the 1942 plans for the Lion class . This was subsequently christened ' Design B ' . The ' B ' proposal scaled back heavily on underwater protection , top speed and reduced the size of the citadel to the minimum possible while dramatically increasing freeboard and retaining much of design A 's armour and firepower . Two further design series ; ' C ' and ' D ' , considered alternative ways of saving weight via reduced armament or belt thickness , but these were quickly deemed unsatisfactory . ' Design B ' became the primary focus and seven proposed versions were produced between March 1944 and February 1945 , of which B3 became DNC 's preference .

By mid 1945 the economic pressures on Britain were becoming paramount and a new proposal , with an armour arrangement similar to the modernized HMS Renown , christened ' Design X ' , was submitted by a design committee headed by Admiral Servaes to the DNC . ' Design X ' , along with the earlier preferred ' B3 ' variant Battleship design were further refined through October of 1945 ,

when further design work was informally suspended on all but the new Mk III 16 inch turret . This work too was finally cancelled by the First Sea Lord in late 1949 and brought a final end to battleship design and construction for the Royal Navy .

= = = Hybrid aircraft carrier = = =

On 8 January 1941 , Rear Admiral Bruce Fraser , Third Sea Lord and Controller of the Navy asked the DNC to work up a hybrid aircraft carrier based on the Lion @-@ class hull . Two months later , a sketch design was presented for consideration , but it was not well liked by the participants . This design retained all three main gun turrets and the flight deck was deemed too short to be useful . A revised version with only the two forward turrets retained was requested and was ready in July . In this design , the displacement ranged from 44 @,@ 750 long tons (45 @,@ 470 t) at standard load and 51 @,@ 000 long tons (52 @,@ 000 t) at deep load . The design 's dimensions included a waterline length of 800 feet (243 @.@ 8 m) , a beam of 115 feet (35 @.@ 1 m) and a draught of 29 feet 6 inches (9 @.@ 0 m) . The flight deck was 500 feet (152 @.@ 4 m) long and had a width of 73 feet (22 @.@ 3 m) . The machinery was unchanged , but 600 long tons (610 t) of additional oil increased her endurance to 14 @,@ 750 nautical miles (27 @,@ 320 km ; 16 @,@ 970 mi) at 10 knots . The hybrid 's armament consisted of six 16 @-@ inch guns in two triple turrets , sixteen 5 @.@ 25 @-@ inch guns and eight octuple 2 @-@ pounder mounts . Twelve fighters and two torpedo bombers could be carried . The Director of Naval Gunnery was particularly pungent in his assessment of the design , " The functions and requirements of carriers and of surface gun platforms are entirely incompatible ... the conceptions of these designs ... is evidently the result of an unresolved contest between a conscious acceptance of aircraft and a subconscious desire for a 1914 Fleet ... these abortions are the results of a psychological maladjustment . The necessary readjustments should result from a proper re @-@ analysis of the whole question , what would be a balanced fleet in 1945 , 1950 or 1955 ? " Not surprisingly , the design was rejected .

= = Construction = =

Six Lion @-@ class ships were planned , two each in the 1938 , 1939 , and 1940 Naval Programmes . The first pair , Lion and Temeraire , were ordered on 28 February 1939 from Vickers Armstrongs and Cammell Laird respectively . Lion was laid down at Vickers ' Walker , Newcastle upon Tyne shipyard on 4 July while Temeraire preceded her at Birkenhead on 1 June . Contracts for Conqueror and Thunderer were awarded on 15 August to John Brown and Fairfield . It is uncertain if Conqueror was actually ordered , but Thunderer was not . Neither ship was ever laid down .

After the start of World War II in September , construction continued desultorily until October when it was suspended by the Admiralty for one year to release labour and material for escorts needed to protect merchant convoys . Construction of the 16 @-@ inch guns and their turrets was to continue , however . The question was raised again on 12 November 1940 and the decision to suspend construction was reaffirmed . All three ships ordered were cancelled in 1942 , but Lion 's keel was not scrapped until after the end of the war . Only four 16 @-@ inch guns , and no turrets , were ever completed .