= Tosa @-@ class battleship =

The Tosa @-@ class battleships (????? , Tosa @-@ gata Senkan) were two dreadnoughts ordered as part of the " Eight @-@ Eight " fleet for the Imperial Japanese Navy (IJN) during the early 1920s . The ships were larger versions of the preceding Nagato class , and carried an additional 41 @-@ centimeter (16 @.@ 1 in) twin @-@ gun turret . The design for the class served as a basis for the Amagi @-@ class battlecruisers .

Both ships were launched in late 1921 , but the first ship , Tosa , was cancelled in accordance with the terms of the Washington Naval Treaty before it could be completed , and was used in experiments testing the effectiveness of its armor scheme before being scuttled in the Bungo Channel . The hull of the second ship , Kaga , was converted into an aircraft carrier of the same name . The carrier supported Japanese troops in China during the Second Sino @-@ Japanese War of the late 1930s , and took part in the attack on Pearl Harbor on 7 December 1941 and the invasion of Rabaul in the Southwest Pacific in January 1942 . The following month her aircraft participated in a combined carrier airstrike on Darwin , Australia , during the Dutch East Indies campaign . She was sunk during the Battle of Midway in 1942 .

= = Background = =

The IJN believed that a modern battle fleet of eight battleships and eight armored cruisers was necessary for the defense of Japan ; the government ratified that idea in 1907 . This policy was the genesis of the Eight @-@ Eight Fleet Program , the development of a cohesive battle line of sixteen capital ships less than eight years old . Advances in naval technology represented by the British battleship HMS Dreadnought and the battlecruiser HMS Invincible forced the IJN to reevaluate on several occasions which ships it considered " modern " and , in 1911 , it restarted the program with orders for the Fus? @-@ class dreadnoughts and the Kong? @-@ class battlecruisers . By 1915 , the IJN was halfway to its goal and wanted to order four more dreadnoughts , but the Diet rejected the plan and authorized only the dreadnought Nagato and two battlecruisers in the 1916 budget . Later that year American President Woodrow Wilson announced plans for ten additional battleships and six battlecruisers , and the Diet authorized three more dreadnoughts in response the following year : a second Nagato @-@ class battleship ? Mutsu ? and two to a modified design , Tosa and Kaga .

= = Design and description = =

The IJN began reevaluating the Nagato design in light of lessons learned from the Battle of Jutland in May 1916 , experiments evaluating armor protection , and newly acquired information on the protective schemes of British and American capital ships . These lessons highlighted the need for better protection of the main gun turrets and magazines , as well as thicker deck armor to protect against plunging fire . Existing methods of defense against mines and torpedoes had also proved to be inadequate and needed improvement . Eleven new designs were rejected between October and early 1917 before Captain Yuzuru Hiraga , superintendent of shipbuilding and the naval architect in charge of the fundamental design of the ships of the Eight @-@ Eight Fleet , presented a heavily modified version of the Nagato design , A @-@ 125 , to be built in lieu of the second ship of the class , Mutsu , on 12 June 1917 , well before she was actually laid down .

Hiraga 's design for the ship reflected the latest combat experience as well as incorporating advances in boiler technology . It added an extra twin main @-@ gun turret , using space and weight made available by the reduction of the number of boilers from 21 to 12 while the power remained the same . He reduced the secondary armament from 20 guns to 16 ; they were moved up a deck to improve their arcs of fire and their ability to shoot during heavy weather . To increase the ship 's protection he proposed to angle the belt armor outwards to improve its resistance to horizontal fire , and to thicken the lower deck armor and the torpedo bulkhead . Hiraga also planned to add anti @-@ torpedo bulges to improve the ship 's underwater protection . He estimated that his

ship would displace as much as Nagato , although it would cost about a million yen more . These changes would have considerably delayed the ship 's completion and were rejected by the Navy Ministry . The rejected design formed the basis for a much larger 39 @,@ 000 @-@ metric @-@ ton (38 @,@ 000 @-@ long @-@ ton) battleship , designated as A @-@ 127 , with nearly twice as much armor weight as the Nagatos . It was designed to achieve the same speed as the older ships , to allow them to maneuver together as a tactical formation . This design was accepted on 27 March 1918 and became the Tosa class .

The Tosa @-@ class ships had a planned displacement of 39 @,@ 900 t (39 @,@ 300 long tons) , and 44 @,@ 200 t (43 @,@ 500 long tons) at a full load . They would have been 231 @.@ 65 meters (760 @.@ 0 ft) long at the waterline , and 234 @.@ 09 meters (768 @.@ 0 ft) overall ; the ships would have had a beam of 30 @.@ 48 meters (100 @.@ 0 ft) and a draft of 9 @.@ 39 meters (30 @.@ 8 ft) . The Tosa class would have had a metacentric height of 1 @.@ 292 meters (4 ft 2 @.@ 9 in) at normal load . A turbo @-@ electric propulsion system was considered for these ships after the United States announced that the system was a great success in the battleship USS New Mexico , and the Japanese estimated that a 70 @,@ 000 @-@ shaft @-@ horsepower (52 @,@ 000 kW) turbo @-@ electric plant could be installed in the Tosa class , which would have given the ships a speed of 25 @.@ 25 knots (46 @.@ 76 km / h ; 29 @.@ 06 mph) , a 2 @,@ 500 @-@ nautical @-@ mile (4 @,@ 600 km ; 2 @,@ 900 mi) range at full speed , and a 7 @,@ 800 @-@ nautical @-@ mile (14 @,@ 400 km ; 9 @,@ 000 mi) range at 14 knots (26 km / h ; 16 mph) , but this system was rejected . More conventional Curtis geared steam turbines were chosen , powered by 12 Kampon water @-@ tube boilers , eight of which would have used fuel oil and four of which would have used a mixture of oil and coal . This system would have provided 91 @,@ 000 shaft horsepower (68 @,@ 000 kW) to four propeller shafts for a top speed of 26 @.@ 5 knots (49 @.@ 1 km / h ; 30 @.@ 5 mph) . The fuel stores would have amounted to 3 @,@ 600 long tons (3 @,@ 700 t) of oil and 1 @,@ 800 long tons (1 @,@ 800 t) of coal ; at a speed of 14 knots , this would have enabled a maximum range of 6 @,@ 500 nautical miles (12 @,@ 000 km ; 7 @,@ 500 mi) .

= = = Armament = = =

The Tosa @-@ class ships were intended to be armed with a main battery of ten 45 @-@ caliber 41 @-@ centimeter guns in five twin turrets , four of which were superfiring fore and aft . Numbered one through five from front to rear , the hydraulically powered turrets had an elevation range of ? 2 to + 35 degrees . The rate of fire for the guns was around two rounds per minute . The ships were designed to carry 90 rounds per gun , although space was available for 110 .

The guns used Type 91 armor @-@ piercing , capped shells . Each of these shells weighed 1 @,@ 020 kilograms (2 @,@ 250 lb) and had a muzzle velocity of 780 meters per second (2 @,@ 600 ft / s) . Also available was a 936 @-@ kilogram (2 @,@ 064 lb) high @-@ explosive shell that had a muzzle velocity of 805 meters per second (2 @,@ 640 ft / s) .

The ships ' secondary armament of twenty 50 @-@ caliber 3rd Year Type 14 @-@ centimeter guns would have been mounted in casemates , 12 on the upper sides of the hull and eight in the superstructure . The 3rd Year Type guns had a maximum range of 19 @,@ 750 meters (21 @,@ 600 yd) at an elevation of + 35 degrees . Each gun could fire a 38 @-@ kilogram (84 lb) high @-@ explosive projectile at a rate up to 10 rounds per minute and was provided with 120 rounds . Anti @-@ aircraft defense was provided by four 40 @-@ caliber 3rd Year Type 8 @-@ centimeter AA guns in single mounts . The 3 @-@ inch (76 mm) high @-@ angle guns had a maximum elevation of + 75 degrees , and a rate of fire of 13 to 20 rounds per minute . They fired a 6 kg (13 lb) projectile with a muzzle velocity of 680 m / s (2 @,@ 200 ft / s) to a maximum height of 7 @,@ 500 meters (24 @,@ 600 ft) . The guns were normally supplied with 250 rounds each , although space was available for a total of 400 rounds per gun . These 3rd Year Type guns were intended to be replaced by four 45 @-@ caliber 12 @-@ centimeter (4 @.@ 7 in) anti @-@ aircraft guns .

The Tosas were intended to mount eight 61 @-@ centimeter (24 in) torpedo tubes , four above water and four below . The former were to be provided with two torpedoes each and the latter with

three each .

= = = Armor = = =

The ships ' armor protection was designed to break up 16 @-@ inch (406 mm) shells from a distance of 15 @,@ 000 ? 20 @,@ 000 meters (16 @,@ 000 ? 22 @,@ 000 yd) and the primary armor plates were backed up by splinter bulkheads intended to contain any shell fragments . They would have been protected by a waterline main belt of Vickers cemented armor that sloped outwards 15 degrees at the top . Amidships it would have been 280 mm (11 in) thick and 254 mm (10 in) thick fore and aft . Approximately 1 @.@ 83 meters (6 ft 0 in) of the armor belt was below the waterline . The side armor was closed off at its ends by bulkheads 229 ? 254 mm (9 ? 10 in) thick . The main battery turrets and the portions of the barbettes above the main deck would have had between 229 and 305 mm (9 @.@ 0 and 12 @.@ 0 in) of armor plating , and the conning tower walls would have had armor 254 and 356 mm (10 @.@ 0 and 14 @.@ 0 in) thick and a roof of 178 mm (7 @.@ 0 in) armor plates . The communications tube below the conning tower would have had walls 76 ? 127 mm (3 @.@ 0 ? 5 @.@ 0 in) thick .

The middle deck was the primary armored deck and was connected to the top of the armor belt . It would have consisted of a 63 @.@ 5 mm (2 @.@ 5 in) plate of New Vickers non @-@ cemented armor on top of a 37 mm (1 @.@ 5 in) plate of high @-@ tensile steel (HTS) above the engine and boiler rooms . Above the magazines , the thickness of the HTS plate would have increased to 63 mm . The lower deck would have consisted of two 19 mm (0 @.@ 75 in) plates of HTS . For the first time in a Japanese ship , the Tosas would have had the lower portion of the single funnel protected by 229 mm of armor . In addition , the funnel openings in the lower deck would have been protected by armor gratings .

The ships would have had an internal torpedo bulge to provide protection against underwater explosions . This was backed by a torpedo bulkhead also made up of three 25 mm (0 @.@ 98 in) layers of HTS and angled outwards to meet the base of the waterline belt . It connected to a 12 @.@ 7 ? 32 mm (0 @.@ 50 ? 1 @.@ 26 in) splinter bulkhead on the lower deck behind the waterline belt . Behind the torpedo bulge and the splinter bulkhead was another splinter bulkhead 12 @.@ 7 ? 19 mm thick .

= = Ships = =

= = Cancellation and fates = =

Construction of both ships began in 1920 , but the 1922 Washington Naval Treaty intervened , mandating the cancellation of all capital ships being built . Work stopped on the two Tosa @-@ class battleships on 5 February 1922 . After being stricken on 1 April 1924 , Tosa 's incomplete hull was used to test her armor scheme against long @-@ range naval gunfire , aerial bombs , mines , and torpedoes . Two of the shells fired at her fell short , but deeply penetrated her hull through the thin armor of the torpedo bulge below the waterline armor belt . This sparked an interest in optimizing underwater performance of Japanese shells that culminated in production of the Type 91 armor @-@ piercing shell . Conversely , the IJN took measures to defend against shells of this type when reconstructing its existing battleships during the 1930s , as well as in the designs of the Yamato @-@ class battleships and the heavy cruisers of the Mogami and Tone classes . Tosa 's torpedo defense system proved able to defeat 200 kg (440 lb) torpedo warheads , but not larger 350 kg (770 lb) ones . After the conclusion of the tests , the ship was scuttled by opening her Kingston valves on 9 February 1925 in 650 m (2 @,@ 130 ft) of water in the Bungo Channel after the demolition charges failed to detonate .

The battlecruiser Amagi , which was being converted to an aircraft carrier under the terms of the treaty , was wrecked in the Great Kant? earthquake in 1923 and rendered unusable . As a result , Kaga , which was originally slated to be scrapped under the terms of the Washington Naval Treaty (

Chapter I , Article IX) , was converted in Amagi 's stead . No work took place until 1925 as new plans were drafted and earthquake damage to the Yokosuka Naval Arsenal was repaired . Although the ship was commissioned on 31 March 1928 , she did not join the Combined Fleet (Reng? Kantai) until 30 November 1929 .

Much like the converted Amagi @-@ class battlecruiser Akagi , Kaga was fitted with two flying @-@ off decks " stepped down " from a flight deck that extended two @-@ thirds of the ship ; in theory , this allowed planes to take off directly from the hangars while other planes landed on the top . As aircraft became heavier during the 1930s , they required longer distances to get airborne and the lower flight decks became useless . Kaga 's 1935 reconstruction removed the lower two decks and extended the top flight deck to the bow . As completed , the ship had two main hangar decks and a third auxiliary hangar with a total capacity of 60 aircraft .

Kaga was provided with a heavy gun armament in case she was surprised by enemy cruisers and forced to give battle , but her large and vulnerable flight deck , hangars , and other features made her more of a target in any surface action than a fighting warship . Carrier doctrine was still evolving at this time and the impracticability of carriers engaging in gun duels had not yet been realized . The ship was armed with ten 20 cm / 50 3rd Year Type guns : one twin @-@ gun turret on each side of the middle flight deck and six in casemates aft . Kaga 's waterline armored belt was reduced from 280 to 152 mm (11 @.@ 0 to 6 @.@ 0 in) during her reconstruction and her deck armor was also reduced from 102 to 38 mm (4 @.@ 0 to 1 @.@ 5 in) . The carrier displaced 26 @,@ 900 long tons (27 @,@ 300 t) at standard load , and 33 @,@ 693 long tons (34 @,@ 234 t) at full load , nearly 6 @,@ 000 long tons (6 @,@ 100 t) less than her designed displacement as a battleship . This reduction in her displacement increased her speed to 27 @.@ 5 knots (50 @.@ 9 km / h ; 31 @.@ 6 mph) and gave her a range of 8 @,@ 000 nautical miles (15 @,@ 000 km ; 9 @,@ 200 mi) at 14 knots (26 km / h ; 16 mph) .

In 1933 ? 35 Kaga was rebuilt to increase her top speed , improve her exhaust systems , and adapt her flight decks to more modern , heavier aircraft . After the reconstruction , the ship displaced 38 @,@ 200 long tons (38 @,@ 800 t) at standard load , better boilers gave her a top speed of 28 @.@ 3 knots (52 @.@ 4 km / h ; 32 @.@ 6 mph) , and additional fuel storage increased her range to 10 @,@ 000 nautical miles (19 @,@ 000 km ; 12 @,@ 000 mi) at 15 knots (28 km / h ; 17 mph) and raised her aircraft capacity to 90 . The ten 20 cm (7 @.@ 9 in) guns , although now all mounted singly in casemates , were retained .

Kaga 's aircraft first supported Japanese troops in China during the Shanghai Incident of 1932 and participated in the Second Sino @-@ Japanese War in the late 1930s . With five other fleet carriers , she took part in the Pearl Harbor raid in December 1941 and the invasion of Rabaul in the Southwest Pacific in January 1942 . The following month her aircraft participated in a combined carrier airstrike on Darwin , Australia , helping secure the conquest of the Dutch East Indies by Japanese forces . She missed the Indian Ocean raid in April as she had to return to Japan for repairs after hitting a reef in February . Following repairs , Kaga rejoined the 1st Air Fleet for the attack on Midway Atoll in June 1942 .

The IJN was surprised by the appearance of three American carriers and , partly due to Admiral Isoroku Yamamoto 's plan in which ships were too dispersed to support each other , Kaga , along with the other three carriers present , was sunk by aircraft from USS Enterprise , Hornet and Yorktown on 4 June .