

Appendix to NANKYOKUKI, the Report of the Japanese Antarctic Expedition, 1910-12

CHAPTER VIII SPECIAL DESIGN FOR SAILING ON ICE-SEA OF THE "KAINAN-MARU"

There seems to be a general interest concerning the details of "*Kainan-maru*", which carried the Japanese Antarctic Expedition Party, enabling it to accomplish its great task.

The "*Kainan-maru*" originally was built in 1910 by Ichikawa Dockyard, Ominato, Ise, by the order of the Hokoku Gikai. When the Expedition was planned, she was purchased from the Hokoku Gikai to be used as the expedition boat. As she was not equipped with a steam engine at that time, a steam engine was purchased from the Yorita Ironworks, Osaka.

The "*Kainan-maru*" is a three-mast wooden heavy-deck schooner with an auxiliary steam engine of 18 HP. Her major dimensions are as follows:

Length	100 feet
Width	25 feet 6 inches
Depth (from the main deck to the keel)	10 feet 9 inches
Gross tonnage (after repair at Ishikawajima Dock-yard)	204 tons

The outline sketch of the structure is as follows.

Keel: zelkova, 10.5 inches wide, 11 inches thick.

Frame: zelkova, 5 inches wide, 10 inches thick cross-grain lamination, frame space being 19 inches.

Keelson: zelkova, 10.5 inches square.

Side keelson: pine, 8 inches thick, 10 inches wide.

Bilge longitudinal: pine, 3.5 inches thick,

10.5 inches wide, 5 pieces parallel.

Garboard strake: Japanese cypress, 4 inches thick, 10 $\frac{1}{4}$ inches wide.

Side plating: zelkova, 3.5 inches thick, 11 inches wide.

Outer side panel: Japanese cypress, 3 $\frac{1}{4}$ inches thick, 40 inches wide.

Outer side plate: Japanese cypress, 3 inches thick, 8 inches wide.

Beams: pine, 9 inches square.

Beams at hatch-openings and masts: pine, 9 $\frac{1}{2}$ inches square.

Pillars: hemlock spruce, 6 $\frac{1}{2}$ inches square (these were set at each beam).

Since the ship was to navigate through drift ice in the Antarctic, about which little was known in Japan, the Ishikawajima Dockyards was requested to try to prepare her as well as possible for that purpose.

Let us describe the special design from the outside. On both sides of the bow, covering a quarter of the total length, 2.5 inches thick plank was attached from the water-line to the keel. The same planking was extended along the water-line from bow to stern, so as to make the upper half of the planking extend above the water-line, with the other half below. The plank was painted with coal-tar. The part below this water-line planking of 2.5 inches was reinforced with double one-inch planks except where the shock of the ice was considered to be greatest, here the 2.5 inches planking was used.

These planks were lined with felt and were

iron plated: 0.125 inch iron plate was used at the part covering a quarter of the total length from the bow, while thinner iron-plate was used on the rest. The bow piece was protected with a cast iron reinforcement 10 feet high. This was to break the drift ice.

To attach the iron-plates, 120 pieces of iron-screws (2 inches long) were used for each plate. But, 24 iron plates near the bow were torn off by raging waves during the first voyage.

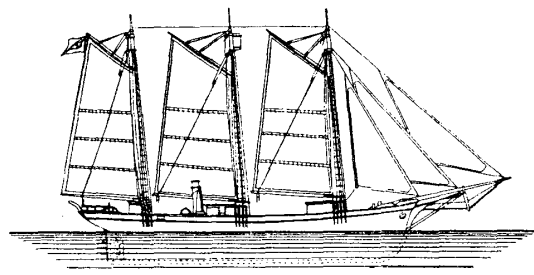


Fig. 1. Outline of "Kainan-maru" (sail shown is used for the first voyage).

To facilitate sailing in the ice-sea, a crew's nest was made on the main mast in order to have a wide view.

The inside structure was as follows: a cabin was newly constructed under the quarter deck for officer's room and the chart room was enlarged a little. A steam engine was installed as an auxiliary at the back of the main mast as seen in the attached illustrations.

Thus the engine room and cabin were constructed at a point two fifths from the stern of the ship. The fore fifth was used as the fittings room, and in the remaining two fifths between the fittings room and the engine room an iron water tank (with 20 tons capacity) was installed. Between the water tank and the engine room, food and other stuffs were stored. Dividing the space under the deck, which is 13 feet high, the upper half of the fittings room was made into the crew's quarters. On the upper deck, the research room at the back of the fore mast, the kitchen at the back of the main mast, six water tanks, each containing five tons of water at the front of the kitchen, and the chart room at the back of

the mizen were constructed respectively. The steering room was situated about six feet behind the chart room. It is needless to say that every care was taken with regards to the strength of these structures.

The outline of the structure of the ship was as described above. As the ship sailed as far south as 74°S, the two forestays of steel, four inches in diameter, at the bow of the ship, were completely frozen. They were subject of great stress from the pounding seas, and due to the severe trembling of the bobstay, they finally broke. The iron band was also broken in the severe cold weather. Therefore, masts developed a rake and the return voyage was prolonged considerably because of this.

During the return voyage, some temporary repairs were continually made and the ship finally was able to reach the Chibley Docks of Sydney.

The major repairs made at the dock in Sydney were as follows: at first the work was confined to installing sufficient buffer along the water-line, as we considered that the point of greatest impact upon collision with ice would be at the part of maximum beam. Therefore the remaining iron plates were to be kept as they were.

But, as the work progressed and the ship dried, all of the remaining screws were found to be useless. In other words, they were fixed to the iron plates only by rust, but were about to fall out because of contraction due to the cold weather. The heads of the screws had all dropped off.

Three new stays were attached. A new iron plate was also installed at the bow. These works were carried out with caution, considering the overall structural strength of the ship. To fix the iron plate, two 2.5 inches screws were used together with three damps. The reason why the damps were used was that the two damps nailed at Ishikawajima Dock-yards were still intact after the voyage.

After the ship was dry-docked, the bow

under the water-line was discovered to have been seriously damaged by ice. This part was repaired as satisfactorily as possible.

On the first voyage, the ship sailed through ice-sea from about March 8. At that time, we could observe only the water-line of the ship, so that we did not notice the damage under the water-line. According to the experts on ice-sea voyage, whom we met in Sydney, however, as seventy percent of the total volume of the ship is below the sea-surface, the lower part is more important than the upper part. On account of this opinion, the front one fourth of the ship was reinforced with iron plates.

New material was used for all the fittings as it was extremely difficult to do repair work on the severely cold sea.

As for the sails, we decided to use the three-quarter sail for the second voyage, because it was found in the first voyage that the strong winds of the Antarctic seldom necessitated the

use of full sails, which were not easy to manipulate. This was really one of the most valuable results of the experience of the first voyage.

Of course, as for the repair work at Sydney hard effort of the Chief Officer TANNO, the Chief Engineer SHIMIZU and all the other crews should be highly appraised.

Thus finishing the repair work, "*Kainan-maru*" departed Sydney toward the ice-sea of the Antarctic on November 19, 1911 and not only allowed the main party to land at 78°31'S, 164°30'W on Bay of Whales, but also allowed the coast party to land at 76°58'S, 154°50'W on a bay of Edward VII Land.

The ship sailed east to attain 151°20'W, 76°06'S and came back dropping anchor in Bay of Whales again. After returning to Japan, she was taken to the Ishikawajima Docks to be examined. In spite of such a long voyage in the ice-sea, no serious damage in the hull was found.

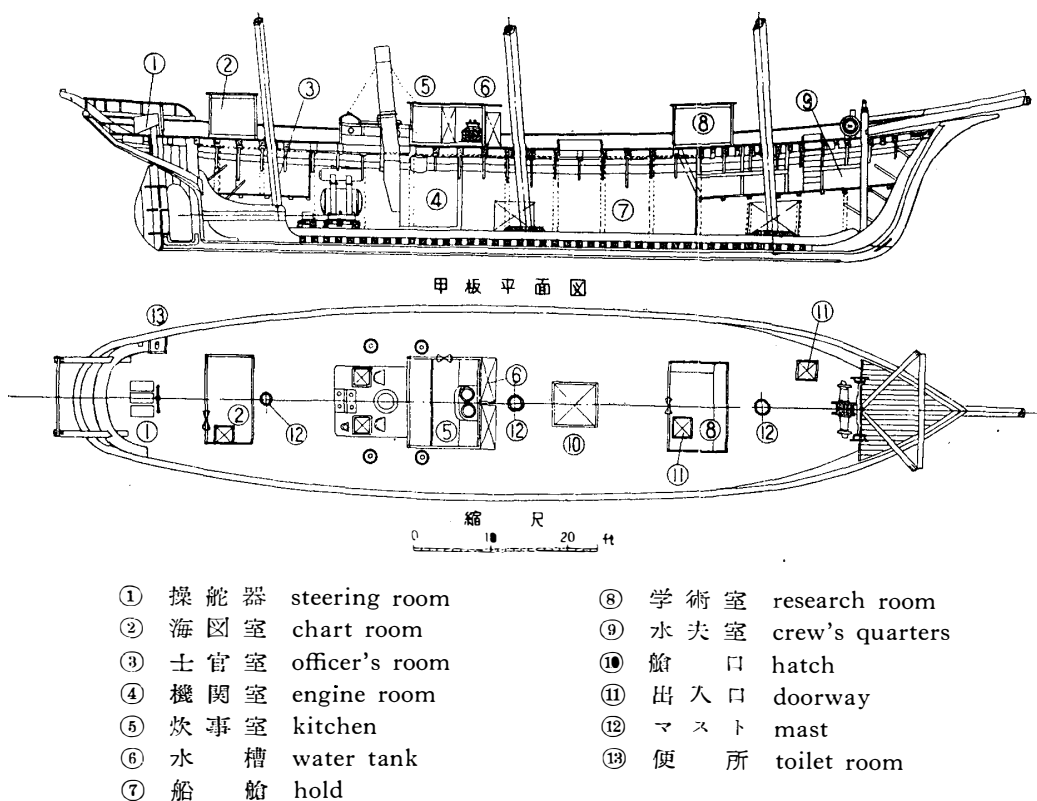


Fig. 2. Cross-sections of "*Kainan-maru*".

CHAPTER IX GENERAL REPORT ON THE VOYAGE IN THE ANTARCTIC REGION

The Antarctic expedition boat "*Kainan-maru*" made a total of four voyages in the Antarctic ocean: in the first voyage it went as far south as $74^{\circ}16'S$ and in the second voyage to $78^{\circ}31'S$. As it is by no means possible to give a detailed description on these voyages, here, I (Captain NOMURA) will give a brief summary of the second voyage in the Antarctic region.

It was 19 November, 1911, when we departed from Sydney Harbour on the second voyage. We, then, swung the ship at a locality 6 seamiles east of the Mac Burry Lighthouse ($33^{\circ}51'S$, $151^{\circ}18'E$) at the mouth of Jackson Bay to determine our compass deviation.

Then, we sailed southeastward for the northern end of Auckland Island ($50^{\circ}20'S$, $166^{\circ}25'E$), which we observed at 17^h 30^m, Dec. 3. At that time, in spite of heavy seas, we were able to ascertain the deviation in our compass and the error in our chronometer by sighting the northeastern point of this island.

Afterward passing this point weather was not too bad, and it was half-clear most of the time. We had occasional showers and the wind was mostly northeast and mild. Then, we proceeded toward the Antarctic region.

According to our experience of four passages, the zone between $50^{\circ}S$ and $55^{\circ}S$ was the most unstable and stormy. When the "*Kainan-maru*" passed this zone on Dec. 7 on the second passage, we had only two hours of night time. Waves were extremely high and the rock and roll of the ship was quite severe, the inclination reaching about 25° .

On Dec. 9, the position of the ship was $60^{\circ}24'S$, $169^{\circ}40'E$. Since the date when the British Antarctic explorer Ross, the earliest who sailed this course, made his voyage was quite near to that of the "*Kainan-maru*" on

this passage, favourable conditions were expected (According to the Map, No. 3173 made in England, Ross passed here on Dec. 23.). On the day we passed the Ross-line, namely Dec. 10, we had snow as fine as sand. At about 18^h, the temperature was $31^{\circ}F$ and the temperature of the sea-water as low as $32^{\circ}F$. On Dec. 11, the snow continued, and the sea-water began to show pale white colour. This colour indicates the approach of ice-sea.

From about Dec. 11, pack ice began to appear one after another more and more frequently. As the temperature of the sea-water was as low as about $30^{\circ}F$ we were always very cautious. The climate was mostly densely foggy and the north wind was strong. In this area dawn was at about one o'clock and at two o'clock it was fully daylight. At twelve midnight it was still like twilight and one could read the newspaper on the deck. We were especially careful because at the time of the first voyage the number of icebergs increased in this area. The atmospheric temperature was $33^{\circ}F$, the temperature of the sea-water $30^{\circ}F$, and the barometer showed 29 inches.

Very large number of whales in groups were sighted, and water-fowls like petrel were also numerous. From about noon, we encountered icebergs which increased in number steadily. We were in ice-sea by this time. On this day, we encountered many icebergs. After about 20^h, nearly all the sea surface was covered by ice. Since the sea became a pure ice-sea, I ordered the preparation of the steam engine.

We continued cruising on the ice-sea. From about Dec. 15, we entered the completely nightless region, where the short period of twilight after the sun sets was the only indi-

cation of night. According to the thermometer, the temperature was 30°F and the temperature of the sea-water 31°F, and the barometer showed 29.5 inches.

At noon of this day, the position of the ship was 64°35'S, 170°E. We cruised on this day, encountering icebergs, some of which were about 300 feet high above the water-surface. Around the icebergs, small pieces of ice were found in clusters.

After Dec. 17, there was not a single fine day. The waves were not high because of the ice upon the surface. Due to our compass deviation, north-east-east became the direction of the destination after passing through the position of the magnetic pole. At the time of the previous measurement, the declination was 4°W. But now, it was found to be 31° 20'E by measuring the position of the sun. After all, one has to be very careful at any time during the voyage in the Antarctic Ocean.

From Dec. 20, icebergs in the shape of a breakwater began to appear. Although we knew that these icebergs were formed by breaking down of the ice front, the appearance of them still gave us great surprise.

On Dec. 21, some red coloured clouds were observed. Where the red cloud is rather thin, beautiful blue coloured cloud began to appear, at one o'clock a.m. On the sea, the icebergs constantly increased and the whole surface became ice-sea while the snow was falling incessantly. We continued to make our voyage by steam-power toward our destination. Our position at noon of this day was 69°41'14"S, 178°E.

From morning toward afternoon, the snow became exceedingly severe and we proceeded with enormous care. But, as we could not make any further headway under the circumstances, we finally got out of the ice-sea area by taking detours. At that time, certain members of the party made certain suggestions as to the course of the ship, on the basis of

what they have heard from Prof. DAVID at Sydney. In my opinion, however, it would be of serious consequences, should the navigator of a Japanese ship have to obey at any cost the opinion of foreigners. Japanese seamen must have proper ability for navigation. I answered them, as the captain, that although I naturally would take their opinion into consideration, I rejected any suggestion demanding blind adherence.

In spite of my above answer, the members of the Research Division still bothered me with repeated requests on the matter. I answered them that, as the voyage of our "*Kainan-maru*" was being watched by the entire world, the captain of the ship must act with great care, and that his commands should be obeyed.

Now, the direct southward advance being impossible, we got out of the ice-sea and ran eastward along the border of the ice-sea looking for a water-way to the south. But, we could not find any such water-way for some time except small inlets 2-5 miles deep. At last, on the 180° meridian, we discovered a southward route between the ice. It was on the 29th of December.

After one whole-day running south on the sea covered by thin ice, we finally reached an open-sea area with little ice. The next destination of the "*Kainan-maru*" was Bay of Whales. But it is dangerous to head directly in that direction, relying on the compass alone.

Because of the large compass deviation in the Antarctic region, it is imperative to establish the ship's bearings by land.

As it was considered to be the most proper way for an ordinary navigator to approach the coast of South Victoria Land and ascertain the values of error of chronometer and compass deviation, before trying to make further progress toward the destination, I decided to do the same. At that time it was rarely fine and the waves were mild: we ran by steam power because the wind was weak.

In due time, we arrived at the area adjacent

to our destination and faced a huge ice-sea. Hence, we could not make any further progress in the direction we wanted. In the next ten days, therefore, we struggled to advance through by taking detours eastward and northward, avoiding the icebergs.

Our desperate endeavours during these days were indeed beyond the imagination of unexperienced people and the danger that the ship faced was extreme.

On January 15, we could finally get out of the siege of ice and barely proceeded southward. At five o'clock in the morning of the next day, an ice barrier attached to the continent was discovered. Getting closer to it at about 10 o'clock, we found a bay-shaped part in it, where the landing of the party seemed possible. Hence, we brought the ship close in. The position of the bay was $78^{\circ}15'S$, $162^{\circ}20'W$.

However, as it finally became clear, through a closer survey by the members landed for trial, that the bay was not suitable for landing, we decided to go out of the bay. At that time, the landing party requested the captain to sail eastward. But, it was not at all sure that we could find a place for landing by such an abrupt change of course, and in the event we couldn't find a landing site, we had to go west again.

Spending our precious time in such a way, we might lose the chance and have to go home without landing. On the other hand, we had been informed that in Bay of Whales, 30 miles west to our position, the landing would probably be easy. Therefore, we proceeded westward and arrived at that bay after six hours. At that time, we came across the Norwegian Expedition Boat "*Fram*" which was moored in the bay. We, at once, moored our ship "*Kainan-maru*" by anchoring on fast ice, two miles east of "*Fram*". It was a little after 23 o'clock and the position was $78^{\circ}31'S$, $164^{\circ}30'W$. Finishing the landing of the inland party with great difficulty at this point, we parted with the landed members

for a while on January 19. Then, after finishing the necessary preparation, such as transposition of coal, in the open-sea, we departed for the expedition in the east, the purpose of which was to go as far east as possible after allowing the members of the branch party to land on Edward VII Land. We wanted to explore as far as $140^{\circ}W$.

Thus, we, along the coast 2 to 3 miles off shore, made a voyage east, during which the weather was mild. We frequently saw ice barrier falling off into the sea. The sound of the falling of the ice barrier was as tremendous as that of the canon shooting. When the ice falls, it creates a huge wave, kicking up a blanket of spray. Some time later large chunks of ice bob up to the surface. They, being set adrift, float out to the open sea as icebergs. Hence, it was dangerous to pass too near the ice barrier. Afterward, we moored the ship at the coast of fast ice off Edward VII Land ($76^{\circ}58'5''S$, $154^{\circ}50'W$). At this place, some members of the party and the ship landed in two parties to explore a part of the Alexandra Mountain Range; one party marched east and the other west. Those who went east soon came back because of the huge crevasse ahead, but those who went west did not come back for a long time. We grew apprehensive about them and sent a searching party composed of members of the ship. In the evening, however, both the party gone west and the searching party came back one after another.

After taking them on board, the "*Kainan-maru*" went further northeast, for a whole day, and then returned from $76^{\circ}06'S$, $151^{\circ}20'W$.

Between the landing point in Edward VII Land and this final returning point, there were plenty of large and small icebergs on the sea. Some of them could be called ice-islands and the voyage was extremely hazardous.

Although we wanted to go east further and survey the area more thoroughly, we had to decide to return because not only the ice-sea

ahead did not seem to allow our return once we enter it, but also the supply of coal and water was getting low. On the way back to Bay of Whales, we got close to the coast of a bay at $77^{\circ}50'S$, $158^{\circ}40'W$, and spent a day there in collecting some fifty rock specimens of various sizes on the ice, sounding the seabottom, and in observing the contacting state of ice and sea-water in cracks on the ice barrier.

We departed the bay saying farewell to numerous whales in groups and returned to Bay of Whales.

Now, the next task was the embarking of the land party aboard ship at Bay of Whales, but the ice at the landing position was found to have drifted away completely and the shape of the bay was largely changed. On that day, the weather was quite threatening and we took refuge at the mouth of the bay many times. It was Feb. 3, when we got close to the coast in a small bay convenient for embarking. The position was $78^{\circ}34'S$, $164^{\circ}42'W$.

At 10 o'clock of 4th Feb., the embarking was completed. If the weather had been favourable, we would have surveyed the bay and explored the coast. But, as the snow became so heavy from noon and the range of vision became extremely limited, we had to drift offshore. Then, we travelled toward Victoria Land for the purpose of collecting penguin and rock specimens.

On Feb. 11, we tried hard to get close to coast of Coulman Island, but the fast moving drift-ice, perilous weather, and high waves due to a strong northeast wind did not allow us to get nearer to the island. We thought of waiting for the recovery of the weather for two or three days, but the possibility of the

recovery in a short time was very little, and the shortage of water was serious. Moreover, if the weather got worse, the danger of the ship would have been quite serious. Therefore, to our regret, we finally decided to go to New Zealand directly. It was Feb. 14.

During the voyage from this point on, the counter-wind was so strong that we could not maintain the planned route and drifted toward the east.

The second voyage, details of which will be published soon, was no less dangerous than first one. It was March 23, when we arrived at New Zealand.

In New Zealand, the "*Kainan-maru*" received a warm public welcome, in which there was a welcome visit of ladies to the ship. These ladies, at first having the impression that such a small boat could not discharge the duties of the expedition, were deeply moved on hearing that we met the "*Fram*" in Antarctica. This was why they wanted to visit us and meet the seamen who had displayed so much courage, in spite of the crudeness of the ship.

Among them there was a 73 years old lady who said to us that she, in her long life, had neither made voyage nor had ever wanted to visit a ship, but came to visit us and was extremely glad to meet us.

A photograph of the ladies and us was taken for memory, and on leaving the ship, the leader of them spoke and commented that they were most impressed with the excellent navigating ability of the Japanese people. The words of that lady were the most pleasant thing for us, for to receive these words of recognition from abroad had been one of the main reasons why we undertook the expedition.

(To be continued)
