ACTIVITIES OF THE HYDROGRAPHIC OFFICE OF JAPAN

(1958-1961)

IHB Note. — On the occasion of the 90th anniversary of its foundation, the Hydrographic Office of the Maritime Safety Board published a special number of the Hydrographic Bulletin (Publication No. 181) which includes some articles on the celebration of this 90th anniversary.

After correspondence on this subject with the Chief Hydrographer of the Japanese Hydrographic Office, the Bureau received a publication entitled : Activities of the Hydrographic Office of Japan 1958-1961, published on the occasion of the Third United Nations Regional Cartographic Conference for Asia and the Far East which was held in Bangkok, Thailand, from 27 October to 10 November 1961. The Chief Hydrographer of the Japanese Hydrographic Office asked us to publish some extracts for the information of Review readers. These extracts, which are limited to items of particular interest to hydrographers, are given below.

I. — GEODESY

1. Astronomy

Photoelectric and visual observations of the occultation of stars by the moon are being continued at the head office in Tokyo (30 cm reflector) and at three hydrographic observatories at Sirahama (34°43′ N, 138°59′ E; 25 cm reflector), Simosato (33°34′ N, 135°57′ E; 15 cm refractor) and Kurasiki (34°35′ N, 133°46′ E; 30 cm reflector). Data were obtained for 453 stars in 1958, 450 in 1959, 426 in 1960 and 173 from January to June 1961. The reduction of this data gave the following values for correction to the moon's longitude and the difference ΔT = Ephemeris Time — Universal Time.

Epoch	ΔL	ΔT
1956.5	— 3.″66	31.″75 ± 0.″16
1957.5	— 4.″38	31.″53 ± 0.″20
1958.5	— 4.″41	32.″57 ± 0.″13
1959.5	— 4.″43	33.″65 ± 0.″15

In order to connect Japan geodetically with the American and Asian continents, observations of occultations are being carried out on the equal lunar limb line which passes through Japan and some islands in the Pacific Ocean; thus Sikoku and Wake Island were successfully connected on 29 May 1958 and Sikoku and Marcus Island on 17 April 1959.

As part of the national project of outer space research, observations of earth satellites and rockets for geodetic purposes are being planned, and some equipment is being designed.

The Japanese Ephemeris, Nautical Almanac and Abridged Nautical Almanac are computed and published annually. Sight reduction tables and nomographs for navigation are also compiled and published. An Altitude-Azimuth Almanac was compiled for the Antarctic Expedition.

2. Levellings and subsidence investigations

In order to establish chart datum and to investigate land subsidences, levellings were made in nine harbours including Osaka, Yokohama and Niigata from 1958 to 1960; 4 harbours are to be studied in 1961.

The data have shown considerable subsidences, particularly in the region of Niigata harbour; precise soundings were made which revealed the subsidence of the sea bottom. It was found that the depth had increased by about 2 metres during the last five years, which is approximately the same as the subsidence observed on land. Soundings are to be made in other harbours for the same purpose.

In the case of levelling operations over the sea, the refraction of light in the atmosphere near the sea surface has been investigated, particularly in relation to abnormal refraction. Detailed experiments were made in 1959 and 1961. Incidentally, it seems possible to show a mechanism of heat exchange between air and water through this study. The experiments are to be continued.

3. Gravimetry

In cooperation with the Department of Geophysics of Tokyo University, a marine gravimeter mounted on a gimbal with an auto-levelling device was tested on board the survey ship *Takuyo* off the south coast of Honsyu in January 1960. Also, in August 1961, a gravimetric survey was successfully carried out off the south-east coast of Japan from Honsyu to Kyusyu using a marine gravimeter mounted on a vertical gyroscope.

The principal part of the gravimeter is a short period pendulum whose frequency is compared four times per second with a standard frequency from a quartz oscillator, in order to exclude the influence of sea waves. This apparatus will be used during the International Indian Ocean Expedition from 1962 to 1963, and after 1963 during the gravimetric survey of the seas adjacent to Japan, as part of the Upper Mantle Project.

4. Geomagnetism

From 1958 to 1960, a new series of magnetic charts was prepared and published for 1955.0 giving variation, horizontal intensity and dip with their respective annual changes, on a scale of 1/10 000 000. These charts were compiled from the data obtained during the Sixth Magnetic Survey of Japan from 1954 to 1955.

The Seventh Survey of Japan was carried out from 1959 to 1960 using a Hydrographic Office type magnetometer at 66 stations at intervals of about 100 km, in order to revise the series of magnetic charts for 1960. Among these, the chart showing variation will be published in November 1961, and those showing horizontal intensity and dip, as well as a secular variation chart, will appear in a forthcoming issue of the Bulletin of the Hydrographic Office, together with detailed descriptions.

In 1958, local magnetic surveys were carried out with an Askania variograph and a Hydrographic Office type magnetometer at Ao-ga Sima and Tori Sima in the Izu Syoto Islands south of Honsyu, Okusiri Sima near Hokkaido, Iki Sima near Kyusyu, and Simabara Hanto Peninsula on the west coast of Kyusyu.

In 1958, a magnetometer was devised for use in aircraft to observe the vertical component. It was used during the first aerial survey of geomagnetism in O Sima and Sagami Nada (gulf) off the south coast of Honsyu. The second survey was carried out in Sagami Nada in 1958 with a magnetometer for obtaining the total component; this was followed by the third and fourth surveys carried out around Izu Syoto in 1959 and 1960 respectively.

In accordance with the resolution adopted at the XIth General Assembly of the IUGG in 1957 concerning the world magnetic survey, an aerial survey will be commenced in February 1962 using a new instrument which is now being manufactured. This survey will cover about 9 000 square nautical miles from the coast of Japan to 300 miles offshore. The instrument to be used consists of a magnetometer with a saturable core inductor of permalloy. It is expected to have an accuracy of 1.1° both in declination and dip, and 50 γ in each component of intensity.

During the International Indian Ocean Expedition, geomagnetism at sea will be observed with a shipborne proton magnetometer on the *Takuyo*.

II. — OCEANOGRAPHY

1. Tides

Nineteen tide stations are being maintained along the coast of Japan in order to maintain accurate tide predictions and chart datum and to investigate extraordinary tidal phenomena and ground subsidence. At these tide stations the temperature at the surface of the water is also observed.

From 1958 to 1960, continuous 24-hour observations of tidal currents were made at 681 stations, and longer observations up to 15 days were made at 5 stations to determine the harmonic constants of tidal currents. In 1961, tidal currents are to be observed at about 200 stations. The instruments used were self-recording and electric currentmeters, and Ekmann-Mertz currentmeters. Tidal current charts are compiled from the data obtained during these observations, and appear in certain hydrographic publications.

The volume of water transported by currents is also observed using the electric current induced in sea water by geomagnetism, which is measured by a potentiometer attached to the end of a submarine cable laid in a channel or in the entrance to a bay. In particular, the variations in the volume of water transported at the entrance to Tokyo Wan (Bay) are studied, as part of a research project for the prevention of disasters in Tokyo caused by typhoons.

Tide tables containing tide predictions for 62 ports, and current predictions for 14 areas, are published annually in two separate volumes.

A DOODSON-LÉGÉ tide predicting machine was installed in 1959 to replace the Kelvin type tide predictor used until then.

2. Oceanographic observations

In order to study the mechanism of seasonal variations in oceanic currents, B.T. and G.E.K. observations are now made quarterly at 961 and 5 448 stations, respectively, as well as oceanographic observations at 996 stations in areas around Japan. The results obtained from these regular observations, together with those obtained by other organizations, are published quarterly in the form of charts showing the oceanographic developments in the seas adjacent to Japan.

In 1959, investigations on the origin of Kurosio and on its short period changes were carried out in the areas between Kyusyu and the Philippine Islands and around Izu Syoto. From 1957 to 1959, observations of underwater currents and of sea level were made as a contribution to the IGY project. Oceanic equatorial currents were also observed simultaneously, in cooperation with several other countries, as part of the same project. Other oceanographic observations were made on board the *Soya* during her annual voyages to the Antarctic.

In April 1960, notification of oceanic currents was recommenced by civil broadcast and telegrams to navigators. The data used result from current observations made regularly twice monthly, mainly on Kurosio.

Investigations of sea ice are being made in the Okhotsk Sea every winter on survey ships and aircraft. Contamination of sea water and bottom sediment due to radio-isotopes is studied in ports and offshore regions, and at the bottom of the Japan Trench.

As a contribution to the International Indian Ocean Expedition planned by UNESCO and SCOR, oceanographic observations will be made in the eastern part of this ocean from November 1962 to March 1963 on board the *Takuyo*. A distance of over 17 000 miles will be navigated. The following observations will be made : serial water sampling, B.T. measurement, chemistry including analysis of radio-isotopes, currents including G.E.K. measurement, meteorology, biology, bottom topography and geology, heat flow at bottom, gravimetry and geomagnetism,.

Various new equipment for oceanographic observations is now being developed, for example a shipborne wave recorder, an airborne radio-thermometer, a high precision salinometer and an automatic observation apparatus which observes oceanographic phenomena during heavy weather in mid-ocean and transmits data to a land station.

3. Submarine topography, geology and sedimentology

With the object of prospecting for oil fields, the sea bottom was investigated off the north-west coast of Honsyu in 1958 and 1959, by means of sounding, dredging and gravimetry to prepare charts of the bottom topography and sediments at a scale of 1/50 000. In some parts of the above area, flat ground composed of coarse grain sediments was found at a depth of about 40 metres.

As part of the reclamation project for Simabara Kaiwan (gulf) on the west coast of Kyusyu, soundings were made and bottom samples taken at about 1 000 points in 1958, to prepare charts of bottom topography and geology. In 1959, supersonic exploration was carried out beneath the bottom surface with a Sparker. It was found that channels had been formed by the erosion due to strong currents, and the neighbouring natural levees followed the direction of the tidal currents. Several channels which might have been formed during the ice age were discovered.

Detailed studies of bottom topography and geology were made as part of projects for the construction of railway bridges and submarine tunnels to connect Honsyu with Hokkaido at Tugaru Kaikyo (strait), and Honsyu with Sikoku at Akasi Seto (strait). In 1958, in particular, a boring survey was carried out at a few dozen points. Cores of bed rock less than 2 metres long were taken from the sea bottom. In 1959, explorations were made with the Sparker at Akasi Seto and Naruto Kaikyo, between Honsyu and Sikoku; these confirmed the geological structure previously inferred after thorough surveys and dredgings in 1957 and 1958 which indicated a structure of faults and anticlines.

In connection with the projects for the construction of a highway between Honsyu and Sikoku, Sparker soundings and dredgings were made along planned routes from 1959 to 1961, to prepare charts of the bottom sediment at a scale of 1/10 000.

As part of the project for the laying of a submarine cable between Japan and Guam Island, Ensyu Nada, off the south coast of Honsyu, investigations were made in 1960 using the Decca Navigator system to prepare charts of submarine topography and geology at a scale of 1/200 000. The detailed structure of the large submarine valley became clear : the bottom of the valley is completely flat. In May 1961, topographic and geological surveys and temperature measurements of bottom water were carried out by the *Takuyo* along several routes connecting Honsyu to Guam Island for the preparation of bathymetric and submarine topographic charts. One result of this investigation was the discovery of extremely flat areas on the sea bottom at depths of between 1 000 and 3 000 metres to the east of Izu Syoto; these areas are crossed by several submarine valleys which flow into the Japan Trench. It was also discovered that the Ogasawara Trough is completely flat for 420 nautical miles, while Mariana Trough forms a very undulated basin. About 20 uncharted seamounts were discovered, including three mounts more than 3 000 metres high.

In order to ensure safe navigation in fairways, emergency surveys were carried out immediately after Typhoon Vera in September 1959, and the tsunami which followed the earthquake in Chile in May 1960. It was found that the paths of tidal waves due to the typhoon were greatly affected by the bottom topography, and that consequently those parts of a dike which lay on the remains of former waterways were more severely damaged than the other parts. Erosions due to the tsunami were found to be influenced by the bottom topography rather than by the height of waves.

During investigations made in the Japan Trench on board the *Takuyo* in 1959, a 2 600-metre seamount was discovered on the eastern side of the trench. Both sides of the trench drop steeply after a depth of about 7 000 metres, although the bed is very flat. Samples of a diatom ooze layer 30 cm thick were taken from the bottom at a depth of 8 065 metres. The southern part of the trench is filled with sediment rich in organic substances. At the bottom particular conditions seem to exist which prevent the flow of water.

In April 1961, the method for taking samples of the deep sea bottom was tested in the Suruga Wan (Bay) on the south coast of Honsyu by taking sample cores 3.5 metres thick at a depth of 3 000 metres.

During the oceanographic observations made in May and June 1959 in the south-eastern part of Kyusyu, a guyot was discovered at a depth of 3 787 metres. It showed a conspicuous shelf and at its foot a moat 250 metres deep and 12 to 22 km wide.

The number of shoals and seamounts discovered up to now in the seas adjacent to Japan has exceeded 500, some of which are given in the list and the map of the attached appendix.

III. — SURVEYS

1. Ordinary surveys

In order to keep the nautical charts up-to-date, the following surveys have been carried out around the coast of Japan :

	Scale	Number of operations				
		1958	1959	1960	1961*	Total
Harbour surveys, 1st order	1/3 000-1/10 000	4	6	2	7	19
Harbour surveys, 2nd order	1/3 000-1/10 000	2	1	4	7	14
Coastal surveys	1/15 000-1/50 000	8	7	5	5	25
Oceanic surveys	1/100 000-1/500 000	6	6	17	15	44
Total						102

* Including surveys to be carried out.

Total of surveys already completed :

	Number of sheets
Harbour surveys	315
Coastal surveys	100
Oceanic surveys	13

2. Special surveys

	Scale	District	Object
1958			
Gravimetric and bathymetric surveys	1/50 000	NW coast of Honsyu	Prospecting for oil fields
Submarine topographic and geological surveys	1/15 000	NW coast of Honsyu	Prospecting for oil fields
Dredgings	1/20 000	Honsyu-Hokkaido Honsyu-Sikoku	Railway construction
Bathymetric, submarine topographic and geological surveys	1/10 000	W coast of Kyusyu	Reclamation
1959			
Gravimetric and bathymetric surveys	1/50 000	NW coast of Honsyu	Prospecting for oil fields
Sparker surveys	1/10 000 1/5 000	Honsyu-Sikoku	Construction of highway
Sparker surveys	1/20 000	W coast of Kyusyu	Reclamation
1960			
Submarine topographic and geological surveys	1/200 000	S coast of Honsyu	Laying of submarine cable
Submarine topographic and geological surveys	1/10 000	Honsyu-Sikoku	Construction of highway
1961			
Submarine topographic and geological surveys	1/500 000	Tokyo-Guam Is.	Laying of submarine cable
Submarine topographic and geological surveys	1/10 000	Honsyu-Sikoku	Construction of highway

3. Equipment

The Decca Navigator system is used mainly for the surveys off Hokkaido. A portable echo sounder for shallow water, designed in 1957, is being modified to meet the following requirements :

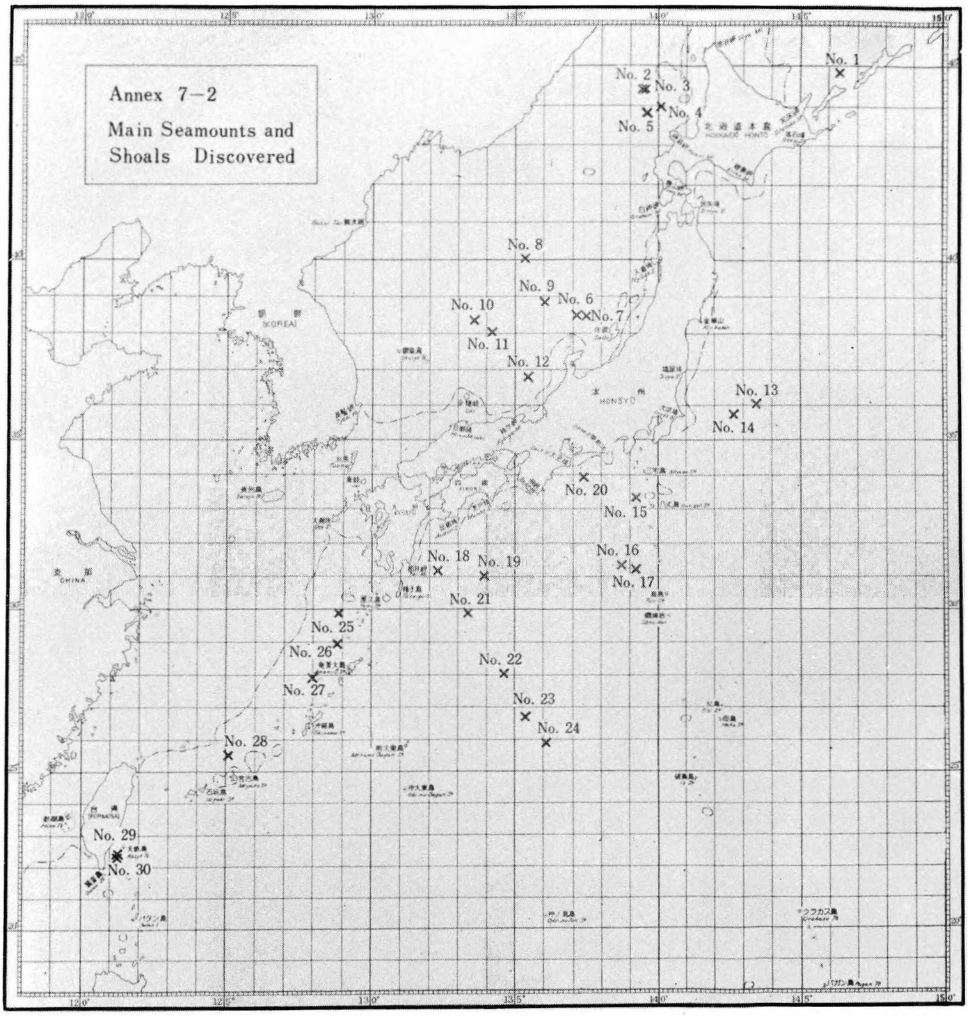
accuracy : $\pm$ 5 cm $\pm$ (0.02·depth); range : 0 — 18 m, 15 — 33 m; power : 100 watts/hour; weight : 20 kg.

For the precise investigation of bottom topography during the International Indian Ocean Expedition, a deep sea echo sounder is being constructed; it is expected to have an accuracy greater than 1/5 000. The stylus is driven by a high precision quartz crystal that can be calibrated by means of a standard frequency. Two recorders, with a maximum range of 2 000 and 200 metres respectively, are driven in synchronization.

The *Takuyo* and another survey ship are equipped with core samplers for deep sea sediments. The instrument is 7 metres long, 80 mm in diameter and weighs about 350 kg. The arrival of the instrument at the sea bottom is detected by a hydrophone on board.

4. The basic marine map

Japan, being an archipelago, has many interests in the maritime field, such a public works, exploitation and transport of ressources. Hence, the Hydrographic Office is setting up a plan based on the " Basic Marine Map ". This map is intended to provide information for every maritime field, e.g. for oceanographic research by means of the preparation of a topographic chart at a scale of 1/50 000 that may be used in the event of an emergency due to disaster, and for navigation by sounding with an atomic submarine (civil), as well as for the preparation of ordinary nautical charts at a scale of 1/200 000.



The survey is scheduled to be completed in ten years, and to cover sea areas up to 100 miles off the Japanese coast using the Decca Navigator system. The interval between sounding lines is 0.3 to 1 mile for plotting sheets at a scale of 1/50 000. The accuracy of sounding is 0.1 to 10 metres and that of position fixing is better than 50 metres.

IV. — DRAFTING AND REPRODUCTION

1. Scope of publications

	Charts	1958	1959	1960	1961 (to be published)
New charts	Nautical charts	8	8	5	13
	Special charts	6	1	6	4
	Aeronautical charts	0	0	0	2
New editions	Nautical charts	27	26	18	21
	Special charts	8	11	7	2
	Aeronautical charts	0	1	0	2
Reprints		28	33	35	29
	Total	77	80	71	73

The number of notices which appeared in the Notices to Mariners for the correction of charts and publications is as follows :

1958 : 1 557
1959 : 1 620
1960 : 1 943
1961 : 1 205 (up to 30 September)

2. Total number of charts available on 30 September 1961

Nautical charts	1 476	Coast of Japan (including 5 Loran charts)	376
		Foreign coasts	1 100
Special charts	209	Bathymetric charts	18
		Submarine geological charts	10
		Fishery charts	17
		Magnetic charts	6
		Others	158
Aeronautical charts	13	WAC	9
		Others	4
		Total	1 698

A programme to cover the whole of the Japanese coast by 36 charts at a scale of 1/200 000 — 1/250 000 is being carried out, six sheets remaining to be prepared.

Loran charts have been compiled and published since 1960. In cooperation with Tokyo University/Mercantile Marine, a radar chart at a scale of 1/100 000 was prepared as an experiment. A series of Antarctic charts has been prepared and revised, the latest chart being S 13.

3. Development and research

The contents of charts are being continuously examined so as to make navigation easier and safer, and to delete unnecessary details on the land area.

Since the recent adoption of the use of aerial photographs in marine cartography, as from 1959 the contour line system has been applied to represent land topography. Since 1958, the stick-on method has been used extensively in the preparation of charts. At present the scribing system is used for about a quarter of the drafting. Some charts are compiled using the mylar base. By using this method, drafting can be done directly from the original sources and figures and symbols can be stuck on easily and accurately.

Since 1959, the zinc plate has been replaced by photographic film as the original copy.

In 1960, the " Neo Vandyke Process " was developed to be used for the photo-mechanical process. By using polyvinyl alcohol as sensitizer, the contact prints obtained from the positive copy of the draft are faintly engraved with lactic acid. The engraved film for reproduction is obtained by reversing the etched copy. This process can be applied widely, for example for film and paper positives, and the lines drawn can be reproduced very clearly without specialists' skill.

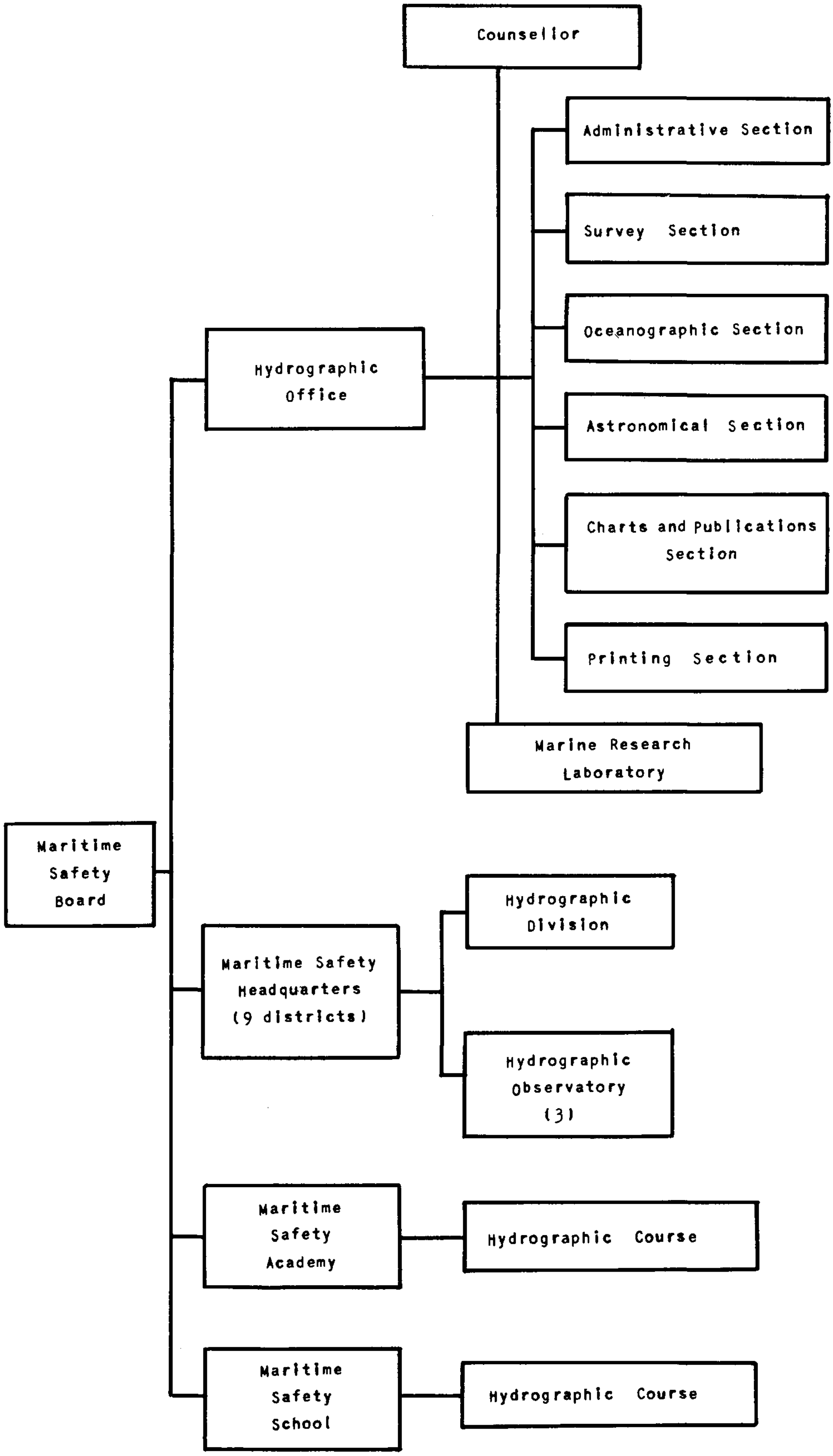
Some publications that contain many Roman letters, various conventional signs and numerical tables are reproduced by photocomposing; the letters or symbols are laid out directly in their original size, then the copy for reproduction is made photomechanically by the Neo Vandyke Process, without exposure in a camera.

Electrophotography is now being investigated with a view to using it for chart reproduction.

The specifications for chart paper were amended in April 1961. The durability of the paper is excellent in relation to various physical changes which may occur.

APPENDIX I

ORGANIZATION



APPENDIX 2

SURVEY VESSELS

	Tonnage	Engine	Speed (knots)	Range (miles)	Construction
Takuyo	771	(Diesel) 650 × 2	12	7 600	1957
Meiyo	355	(Recipro.) 1 400 × 1	10	2 700	1943
Kaiyo	203	(Diesel) 400 × 1	10	1 500	1942
Tenyo	121	(Diesel) 230 × 1	10	3 160	1961
Heiyo	51	(Diesel) 150 × 1	9	670	1955

Surveying boats : 21 (109 t)

Total : 26 vessels (1610 t)

MAIN INSTRUMENTS ON VESSELS

For surveying	For oceanography
Takuyo Precise echo sounder for extreme depths Precise echo sounder for deep sea Loran, 2 Piston core sampler Tapered wire (12 000 m) and winch (120 h.p.) Decca Navigator System* Dredger* Snapping sampler*	Wire and winch (8 000 m, 15 h.p. for serial water sampling) Wire and winch (3 000 m, 5 h.p. for serial water sampling) Wire and winch (1 500 m, 3 h.p. for serial water sampling and B.T.) Self-recording thermometer G.E.K. B.T. Water bottles Protected reversing thermometers Unprotected reversing thermometers Photoelectric colorimeter Scintillation counter
Meiyo Precise echo sounder for extreme depths Precise echo sounder for shallow water Loran	Wire and winch (8 000 m, 15 h.p. for serial water sampling) Wire and winch (1 500 m, 3 h.p., for B.T.) G.E.K. B.T. Water bottles Protected reversing thermometers Unprotected reversing thermometers

* These instruments are occasionally transferred for use on other vessels.

Kaiyo Precise echo sounder for deep sea work Precise echo sounder for shallow water Loran	Wire and winch (3 000 m, 5 h.p., for serial water sampling) Wire and winch (1 500 m, 3 h.p., for B.T.) G.E.K. B.T. Water bottles Protected reversing thermometers Unprotected reversing thermometers
Tenyo Precise echo sounder for deep sea work Precise echo sounder for shallow water Loran	Wire and winch (3 000 m, 5 h.p., for serial water sampling) Wire and winch (1 000 m, 2 h.p., for B.T.) G.E.K. B.T. Water bottles Protected reversing thermometers Unprotected reversing thermometers
Heiyo Precise echo sounder for deep sea work Precise echo sounder for shallow water	Wire and winch (1 500 m, 3 h.p., for serial water sampling and B.T.) G.E.K. B.T. Water bottles Protected reversing thermometers Unprotected reversing thermometers

APPENDIX 3

QUALITY SPECIFICATION OF 135 kg CHART PAPER

Amended on 1 April 1961

1. Size should be 765 $\times$ 1 085 mm, allowing for an error of $\pm$ 1.5 mm. Each corner of paper should be cut rectangular, the longer side being exactly parallel to the machine direction.
2. Thickness should be 0.17 $\pm$ 0.01 mm.
3. Average expansion should be within 0.20 % both in the machine and cross directions, allowing for relative humidity increase from 65 % to 80 %.
4. The paper should be able to withstand folding at least 1 500 times along both directions.
5. Tensile breaking strength should be, on the average, over 15.0 kg in the cross direction and over 7.5 kg in the machine direction.
6. Smoothness of the felted side should be on the average over 50 seconds.
7. The average weight of paper should be 163 $\pm$ 8 gr/m^2.
8. The paper should be suitable for writing on in pencil or in ink, and should not become nappy by erasing with india rubber or knife, and never show ink blots after a test for rub endurance.

9. Surface strength of paper should be greater than 18 on Dennison wax number scale.
10. Area of a dirty spot should not exceed 0.2 mm^2 so as not to hinder reproduction and use.

SUPPLEMENTARY QUALITY SPECIFICATION OF 135 kg CHART PAPER

Amended on 1 April 1961

1. The average bursting strength should be greater than 5.0 kg/cm^2.
2. The average tearing strength should be over 180 g along both the machine and the cross directions, and it should be over 200 g in the wet state.
3. pH value of paper should be greater than 4.5.
4. Degree of sizing should be over 200 seconds, on the average.
5. Brightness should be over 80 %, on the average.
6. Spectral reflectivity should be approximated to the following table :

Wave-length	400	420	440	460	480	500	520	540	560
Reflectivity %	78	82	85	88	90	91	93	93	93
Wave-length	580	600	620	660	700				
Reflectivity %	92	93	93	93	94				

7. Opacity should be greater than 93 % in dry air, on the average.
8. The paper should keep 77 % in degree of brightness during the 4-hour exposure with the Atlas type fadeometer.

APPENDIX 7-1

PRELIMINARY LIST OF THE MAIN SEAMOUNTS AND SHOALS DISCOVERED

No.	Latitude	Longitude	Depth	Surrounding Depths	Date of survey	Vessel	Remarks
1	44° 51′.2N	146° 23′.7E	336 m	1 500 m	8/V/1942	*Toyama-maru*	
2	44° 24′.7″	139° 29′.8″	262	1 000	8/IX/1952	*Kaiyo-maru* No. 4	
3	44° 24′.5″	139° 31′.6″	238	1 000	2/VIII/1949	*Oshoro-maru*	Shoal examination.
4	43° 58′.8″	140° 3′.7″	194	700	8/IX/1952	*Kaiyo-maru* No. 4	Shoal examination.
5	43° 49′.4″	139° 39′.0″	853	1 700	13/IX/1952	*Kaiyo-maru* No. 4	
6	38° 30′.2″	137° 7′.4″	239	800	10/VIII/1957	*Tenkai*	HAKUSAN-SE (shoal).
7	38° 27′.2″	137° 21′.6″	252	800	4/VIII/1957	*Tenkai*	HAKUSAN-SE (shoal).
8	40° 2′.4″	135° 19′.2″	616	1 200	7/VIII/1943	*Toyama-maru*	
9	38° 51′.5″	136° 1′.5″	797	2 300	7/VIII/1943	*Toyama-maru*	
10	38° 23′.9″	133° 32′.5″	724	1 200	18/IX/1956	*Kaiyo-maru* No. 4	
11	38° 3′.2″	134° 11′.1″	397	700	25/IX/1956	*Kaiyo-maru* No. 4	
12	36° 47′.7″	135° 29′.4″	646	1 200	14/VI/1953	*Kaiyo-maru* No. 4	
13	36° 4′. 8″	143° 28′.0″	2 662	5 500	22/IX/1959	*Takuyo*	KASIMA-KAIZAN (seamount) No. 2. Discovered by the *Takuyo* in 1959 at a depth of 2 889 m.
14	35° 47′.4″	142° 39′.3″	3 614	6 000	9/VIII/1957	*Meiyo*	KASIMA-KAIZAN (seamount) No. 1. Discovered by the *Komahasi* in 1934 at a depth of 3 937 m.
15	33° 19′.5″	139° 15′.5″	204	1 200	7/VIII/1960	*Takuyo*	
16	31° 20′.2″	138° 44′.9″	1 313	2 300	12/V/1941	*Soya*	

PRELIMINARY LIST OF THE MAIN SEAMOUNTS AND SHOALS DISCOVERED

No.	Latitude	Longitude	Depth	Surrounding Depths	Date of survey	Vessel	Remarks
17	31° 13′.9″	139° 13′.9″	653	1 200	18/III/1941	*Komahasi*	
18	31° 9′.7″	132° 19′.0″	1 512	2 000	5/VIII/1961	*Takuyo*	HYUGA-KAIZAN (seamount). Discovered by the *Komahasi* in 1939 at a depth of 1 774 m.
19	31° 0′.4″	138° 58′.7″	192	1 000	24/X/1936	*Komahasi*	Shoal examination.
20	33° 57′.4″	137° 21′.6″	776	1 200	11/III/1939	*Komahasi*	
21	29° 53′.8″	133° 19′.3″	289	1 600	25/III/1939	*Komahasi*	Shoal examination.
22	28° 5′.2″	134° 39′.8″	500	2 200	5/VIII/1960	*Komahasi*	KOMAHASI-KAIZAN (seamount). Discovered by the *Komahasi* in 1940 at a depth of 440 m.
23	26° 45′.6″	135° 22′.5″	270	1 500	18/IV/1938	*Kosyu*	Shoal examination.
24	25° 52′.5″	136° 4′.5″	1 336	2 000	6/III/1935	*Komahasi*	
25	29° 54′.7″	128° 52′.9″	69	280	27/V/1951	*Kaiyo-maru* No. 4	
26	28° 57′.2″	128° 48′.9″	649	800	28/VI/1941	*Kaiyo-maru* No. 1	
27	27° 55′.1″	127° 58′.0″	472	900	13/II/1940	*Komahasi*	
28	25° 35′.3″	125° 4′.6″	960	1 600	3/XI/1939	*Komahasi*	
29	22° 25′.7″	121° 13′.8″	417	1 000	28/II/1940	*Komahasi*	
30	22° 19′.8″	121° 13′.0″	715	1 000	28/II/1940	*Komahasi*	

Note :

(1) All the above vessels belong to the Hydrographic Office except the *Oshoro-maru* (No. 3) of Hokkaido University.

(2) The names inserted in the Remarks column are temporary.

(3) Each seamount or shoal marked on the attached map (annex 7-2) is identified by the number in the first column.