The Unsurveyed World, 1874

Staff-Commander T. A. Hull R.N

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Ebening Meeting.

Monday, February 1, 1875.

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NAMES of MEMBERS who joined the Institution between the 19th January and 1st February inclusive.

LIFE.

Salmond, F. M., Captain 21st R. N. B. Fusiliers.

Bayley, J. A., Major late 52nd Regiment.

Heathcote, C. Geo., Lieutenant 5th Fusiliers.

ANNUAL.

Swale, John L., Captain 7th Hussars.

Darwin, S. C., Lieutenant R.N.

Hoste, D. E., C.B., Colonel R.A.

Le Grand, F. G., Captain R.M.L.I.

THE UNSURVEYED WORLD, 1874.

By Staff-Commander T. A. HULL, R.N., Superintendent of Charts, Admiralty.

"From constantly comparing maps and charts, and noting the progress and direction of discovery, Columbus was led to perceive how much of the World remained unknown, and to meditate on the means of exploring it."—*Washington Irving.*

It has been remarked by a modern historian, in reflecting on the brilliant deeds and steadfast valour of our sailors during the wars of Napoleon, that the Navy of this country was destined to rival in the annals of the world the celebrity of the Roman Legions.

But it is not in deeds of arms alone that these distinguished bodies of men are rivals. As in old time "out of the eater came forth meat, and out of the strong came forth sweetness," so out of the horrors of war come arts essential to the blessings of peace. To insure the success of their warlike designs, both Roman soldier and English sailor added considerably to the future comfort and safety of humanity—the Roman, by making roads; the Englishman, by constructing charts.

What roads are to the soldier, charts are to the sailor, and it is easy to prophecy that England's charts will acquire a greater fame than even the Roman roads.

All of you who are accustomed to drive, know the comfort of a good road, on a dark night. Raise that comfort to the highest power of which your imagination is capable, and you will have some slight idea

of the solace that a trustworthy chart is to the captain of a ship in a dark night and in a gale of wind.

But charts, like roads, require constant attention and repair. The roads made by the Romans in Great Britain gradually fell into decay, and the attempts that were now and then made to repair them were insufficient to prevent England falling into a worse state with respect to its highways, than most other European countries.

It is to arrest a similar decay in the charts of our ocean highways, that I have, with the kind permission of the Council, ventured to intrude myself on your notice this evening.

It is, I am sorry to say, too often the fashion when matters do not go quite as we like them, for us Englishmen to find fault with the Government of the day, when the blame really lies upon our own shoulders. The zeal, ability, and management displayed by the various Hydrographers have been most severely taxed in struggling against the rigid economy which the people of this country desired to have carried out in the public service. I am therefore most anxious this evening to persuade my audience to take an interest in this, to Englishmen, important subject, and request their representatives in Parliament to increase the scientific vote, so that the surveying wants of the nation and mercantile community may be promptly carried out.

I flatter myself that I may be successful, for as far back as January, 1873, I detected a slight turning of the tide, when a leader in the *Daily News* pointed out that although our mercantile Navy had steadily increased from 4 to 7 million tons, our surveying forces had as steadily decreased. And yet the Hydrographic Office is in a great measure self-supporting, as the sale of our charts and books is very large, and might be made larger, by using the ordinary mercantile means of increasing the size of an establishment, to meet the wants of the customers.

In December, 1873, the letter of Sir Bartle Frere, in reply to one from Mr. Gladstone, on the Arctic Expedition, came to cheer and encourage the Surveying Service; one portion of it so fully sets our case in its true light, that I must ask you to allow me to quote it.

After a short preamble, Sir B. Frere writes as follows:—

"You will, I am sure, pardon me for taking exception to the expression in your letter which indicates an opinion that voyages for survey or discovery are not strictly 'professional naval services.' I believe that in these days, when it is so difficult to find a seaman's training for our young Officers and men, when so much of the work is done by machinery, there are few better naval schools than a surveying ship; and that, if such ships were multiplied, not only would commerce benefit, but your men-of-war would be better supplied with practical seamen, both among men and Officers, than is possible at present.

"This is still more the case with regard to any Arctic voyage of discovery. Service in the Arctic Seas, under any conditions, is one of the best possible schools for seamen, and is one of the few schools which now remain by which a thorough seaman can be formed, quite equal to the best men of former days.

"Moreover, as a matter of fact, some of our very best practical Officers are men who distinguished themselves in Arctic exploration; and I doubt whether there is a single hour of any Arctic voyage of discovery which, in a strictly professional point of view, may not be considered well spent as training for any naval service."

I hope, Sir, to be able to show how correct were Sir Bartle Frere's assertions.

The above letter called forth another vigorous article from the *Daily News*, in January, 1874; while the *Geographical Magazine*, edited by Mr. Clements Markham, one of the Secretaries of the Royal Geographical Society, in an able article in the April number, on the "Hydrographical Department of the Admiralty," called attention to the reductions in the scientific force. In the July number a similar article on the "Indian Marine Surveys" showed that although it was one of the obvious duties of a country with an extensive seaboard and a great seaborne trade, to provide for the safety of the vessels which frequent her ports, by the provision of lighthouses and buoys, and above all, by the preparation of reliable charts and sailing directions, yet nothing had been done for a space of 12 years for the coasts of our Indian Empire.

It was thus that the change in public opinion, acting upon a mind I fear more enthusiastic than intellectual, nerved me into drawing up this paper, and constructing the chart before you.

On this outline chart of the world I have endeavoured, by means of colour, to depict, faithfully, the present state of hydrography; and I fear that there will be little difficulty in showing that the title given to the chart, is a correct one. The surveyed coasts are coloured red; those only partially surveyed, blue; while coasts that have merely been explored, are coloured brown.

On the small chart (Plate II) which accompanies this paper however, the shores, marked by a *heavy coast line*, are pronounced to be surveyed; the *shaded* coasts are only partially surveyed, *i.e.*, although the charts of those regions answered tolerably well for the time when they were made, modern progress, steam, and the increase of shipping, require that these coasts should be more thoroughly examined. A large portion of the chart is drawn only in *fine outline*; this indicates that such portions have not been surveyed; they have been merely explored. The bridle-paths or log-roads of the ocean, cut and laid with wonderful energy and ability by such men as Dampier, Cook, Vancouver, and others, whom Froude has well spoken of as "England's forgotten worthies." They are forgotten, perhaps, by the many, but well-known to a few, who, although feeling themselves very far from the inferiors of these Vikings in ability, are nevertheless animated by the same earnest wish to do their work at home and abroad fearlessly, against all risks, and to whom such sailors become patterns worthy of even the faintest imitation.

In the chart, from the vastness of the subject, I fear many errors will be detected by sailors knowing the respective coasts; I shall only be too glad to find that there should be more thick coast line upon the chart, but I trust no one will be able to remove that line, or the shading.

The ships upon the chart show the stations of the three regular surveying vessels at present in commission; the crosses show the head-quarters of Officers stationed on shore, doing their best with hired boats and crews. The large cross in the Bay of Bengal, represents the Indian Marine Survey, lately established by Lord Salisbury.

Marine surveys are carried on, either by regular men-of-war fitted for the purpose, or by small hired vessels with hired crews, the latter being adopted where practicable, with a view to economy. I will, therefore, first call your attention to the surveys at present in progress, taken chiefly from the Hydrographer's report to the Royal Geographical Society in May last.

First, there is the "Shearwater," under Commander Wharton, lately employed upon the east coast of Africa, and in taking the Transit of Venus-observers from the Cape to Rodrigues. The "Nassau," under Lieutenant Gray, is still working upon the east coast south of Zanzibar, where their labours have lately been rewarded by the discovery by Navigating Lieutenant J. Dixon of a fine harbour; and the "Sylvia," stationed in Japan, where Captain St. John and his able assistant, Navigating-Lieutenant W. Pearce, are ordered to survey the southern coast of Nipon. The half ship, on the east coast of England, represents the "Porcupine," wherein Staff-Commander John Parsons, with two assistants and a hired crew, have been closely sounding the approaches to Harwich; the work extended from Orfordness to the Naze, and included seaward as far as the Shipwash and Gunfleet Sands. A similar close examination of the shores from the South Foreland to Dungeness was made; the soundings extending from the coast from three to five miles. Dover Bay was also surveyed in close detail, in anticipation of the proposed harbour-works, in continuation of the Admiralty Pier.

Staff-Commander D. Hall made during 1873, in addition to local surveys of the Medina River and Cowes Roads, a minute examination of the bar at Portsmouth Harbour. This survey, consequent on the dredging operations of 1871-2, shows that the proposed depth of 20 feet at low water ordinary spring-tides, has, with the exception of a few spots of 19 feet, been realised. The completion of this valuable channel into our great naval arsenal cannot be overrated. Up to 1863, a line-of-battle ship was obliged to discharge her guns in order to proceed from Spithead to Portsmouth Harbour; now any ship, drawing 25 feet, can enter at three-hours' flood, and the heaviest draft ship at high water.

East Coast of Ireland.—Staff-Commander Kerr and two assistants, in a small hired steamer, have made a patient examination of the off-lying shoal banks between the Tuskar Rock and Wicklow Head. The changes that had taken place in these banks, since their survey in 1844 by the late Captain Frazer, have been of sufficient importance to navigation to demand this re-survey, and to necessitate their re-buoyage, a work now performed by the Commissioners of Irish Lights.

An examination of the bar at Wexford, at Kingston Harbour, the bar of the Liffey River, and the new cutting through the bar of Lough Carlingford, formed also a portion of the season's work. Gratifying

marks of improvement present themselves in the two last-named localities. The bar of the Liffey has now 15 feet at low-water-springs over a breadth of two cables, and a narrow lane of $17\frac{1}{2}$ feet. In 1800, the greatest depth was but $5\frac{1}{2}$ feet; in 1856, 13 feet. Lough Carlingford Bar, with its cutting of 400 feet wide, and a depth of 18 feet, opens up a fine harbour. A line of steam-vessels now runs to the new harbour-works and railway at Greenore, on the west side of the Lough.

Navigating Lieutenant Millard is continuing the survey of the north coast of Sicily, on which Commander Wharton in the "Shearwater" was engaged, before she was detached to increase the squadron required off Zanzibar.

West Indies.—Staff-Commander George Stanley and one assistant, in a hired schooner, have been engaged on the south coast of Jamaica. The chief operations of the survey were the charting and sounding off to the 100-fathom line, the coast between Port Royal and Morant Point—a work of difficulty, owing to the fierce trade-winds which usually blow in that district. In the latter part of 1873, yellow fever, of a malignant type, broke out at Kingston and Port Royal. Many deaths ensued, and among the victims was a promising young Officer, Navigating-Lieutenant Thompson, attached to the survey.

Newfoundland.—Navigating-Lieutenant William Maxwell and party, in the hired steam-vessel "Gulnare," have been actively engaged in various localities. On the south coast the survey progressed 20 miles to the eastward. A re-survey of Port Hood, in Cape Breton Island, owing to great changes in the depth of water in certain parts, was made at the request of the Government of the Dominion of Canada. The coast of Labrador, from Cape St. Lewis to the latitude of 54° N., was also examined, the prominent head-lands fixed, and outlying islands surveyed. The short time during which this survey can be profitably prosecuted makes it an arduous service. The difficulties of the season's work at the beginning were further enhanced by the immense number of icebergs aground along the shore.

In *Western Australia*, Navigating-Lieutenant Archdeacon and his assistant have surveyed, in laborious detail, the entrances and approaches to Cockburn Sound, Owen's Anchorage, and Gage Roads, with the view to certain harbour-works in the interests of the colony. The service on this exposed coast in whale-boats, and with crews found by the colony, by which slender means the duty was accomplished, is worthy of record. The party have now completed the northern and western approaches to Swan River, and surveyed the small, but rising port of Champion Bay.

In *South Australia*, Staff-Commander Howard and staff have completed the soundings off the southern shores of Kangaroo Island. In Spencer's Gulf, several islands and dangers seaward of Port Lincoln were examined, and soundings in detail were taken. The coast-line from Cape Catastrophe to Point Avoid, the inner waters of Coffin's Bay, and the sea-coast thence to Point Drummond, have also been surveyed. Soundings off the wild line of coast, westward of Cape Catastrophe are now in progress.

Victoria.—The surveying party under Staff-Commander H. J. Stanley have been chiefly employed in completing the coast-line of King Island at the western entrance of Bass's Strait, and in sounding around. The bank of soundings, extending seaward from King Island in the direction of Portland Bay, was found to extend 30 and 40 miles from the coast, and then to drop suddenly to depths greater than 150 fathoms. This bank of soundings should afford material aid to the navigator making the land in thick weather.

Queensland.—Staff-Commander Bedwell, in the hired schooner "Pearl," aided by a steam launch, is steadily working northward towards Torres Straits. Port Bowen, Island Head, Strong-tide Passages, Shoal-water Bay, Broad Sound, and several islands of the Northumberland group, have been included in the year's survey. Navigating-Lieutenant Connor, detached from the "Pearl," has been employed surveying the Brisbane River, and the entrance of Endeavour River where Cook refitted the "Endeavour" in 1770, after nearly losing the ship on a reef in the neighbourhood.

South-west Pacific.—The cross near the Fiji Islands represents Lieutenant L. S. Dawson, R.N., our itinerant surveyor in this part of the world. Lieutenant Dawson is placed at the disposal of Commodore Goodenough, to carry out such work as may be most urgently required. I can answer from some years' experience of this Officer, that if he had a ship under his command, he would not only be able to do more work, but would also soon turn his Officers into Nautical Surveyors.

The large cross in the Bay of Bengal represents the Indian survey lately established under Commander A. D. Taylor. I shall treat of this survey farther on.

In addition to the above, we have the assistance of a few zealous Officers of the Royal and Mercantile Navies; the Surveying Service like the Navy and Army possessing its volunteers. Their services will be presently alluded to.

Returning to the coasts, those of England may be considered as surveyed; but let me impress upon your minds, that owing to their shifting nature, the sands surrounding our shores require constant watching and examination. A late celebrated minister once remarked, as a reason for reducing the surveying staff, "That when he had last gone out of office, twenty years before, he had left an Officer surveying the mouth of the Thames; and on his return to Whitehall he found the same Officer employed upon the same duty."

Now, politically, I believe this was a very clever remark, but hydrographically it was a little dull, for the mouths of rivers are often found to be as changeable as the minds of men. To keep the British charts in good working order, a strong surveying staff is not merely necessary, but absolutely indispensable.

The dark line naturally prevails over European coasts. Dutch and French coasts are so marked, but a glance at the charts will show that shade is, as a general rule, the correct symbol for the shores of the Peninsula. In the Mediterranean, the coasts of Algiers and

Tunis are surveyed as far as the Gulf of Kabes; the coast, then, with the exception of the harbour of Tripoli, is little better than explored or unsurveyed until we reach Benghazi; thence to Alexandria it may be called partially done, while from Alexandria to Iskanderoun, we are again upon a well surveyed shore.

But I will not weary you with a description that I fear would be tedious; to make the paper, therefore, more interesting, we will return to Plymouth, take ship, and go a voyage round the world, noting as we sail along, the surveyed and unsurveyed shores that we pass.

Madeira and the Canaries may be considered as done; the Cape de Verd Islands, however, require further examination; on reaching the coast of Brazil, we first anchor at Bahia, a surveyed port, with however some unexamined shoal-ground on the western side of the entrance.

Pushing onward to Rio we are still on the black line. Leaving that beautiful harbour, we enter a partially-surveyed region until we come to the River Plate, of which a survey is much required; it was patched a few years back by Lieutenant Dawson working in a gun-vessel detached for the purpose; the French and Americans have also contributed portions, but it has never been fairly surveyed throughout.

The partial survey of Admiral Robert FitzRoy carries us next to Cape Virgins. In mentioning the name of FitzRoy, I must pause to admire how much was done by this earnest surveyor, who with comparatively small means, and in an extraordinarily short time, mapped the Continent of South America from the River Plate in the Atlantic, to the River Guayaquil in the Pacific.

Admiral Sir Francis Beaufort, in his return made to the House of Commons in 1848, remarks, "That all that is *immediately wanted* of these shores has been already achieved by the splendid survey of Captain Robert FitzRoy."

I call your attention to the important words "*immediately wanted*," that was upwards of a quarter of a century ago, before the days of steamships, 375 feet long, and before the Strait of Magellan was the high road to the Pacific Ocean.

Rounding Cape Virgins, we enter the Strait of Magellan. Excellent charts, constructed by Captain R. Mayne, R.N., and his able Lieutenant Francis Gray, carry us safely onward for 110 miles, when we again enter the shaded or partially surveyed ground. After passing the southern bend of the straits, the "Royal Naval Reserve" comes to the assistance of the Hydrographic Office, in the person of Lieutenant S. T. Lecky, a worthy Fellow of the Royal Geographical Society, and a Captain in the service of the Pacific Steam Navigation Company. This gentleman, ably assisted by Officers whom he had trained to the work, has furnished us with a running survey (that would reflect credit on any Admiralty Surveyor) extending from Cape Cross-Tide to Cape Pillar, a distance of 100 miles. In his last voyage he made several valuable corrections and additions to our charts on the coast to the northward of Cape Pillar. I may here mention that Captain Lecky acquired his knowledge of nautical surveying when in the service of the Honourable East India Company.

We should like to continue our voyage by the inner channels leading northward of Magellan; but there are orders from the owners against using these partially surveyed waters, and we are reluctantly forced into the Pacific (an ocean by no means worthy of its name in the vicinity of Cape Pillar), with a loss of fuel and comfort, and with great wear and tear to ship and engines.

Captain Mayne's work combined with that of Captain Lecky (whose survey enabled the Hydrographic Office to connect the detached works of King and FitzRoy), supply a tolerable chart of the Strait of Magellan; but the rapidly increasing traffic of large and powerful steamers through this great connecting link between Europe and the western coasts of America, points urgently to the necessity of completing the survey of Magellan Strait, and the channels northward to the Gulf of Peñas.

Pursuing our course along the coast of Chile, whose increasing trade with this country would be much benefited by better charts, we touch at Valparaiso, Callao, and Payta; but it is not until we reach the River Guayaquil that we are in the vicinity of a coast, of which we possess reliable charts. From Guayaquil to Panama we are on the dark line, and, therefore, venturing nearer to the shore, we can coast along one of the most beautiful and interesting parts of the globe; passing La Plata Island, where Drake divided the spoils of the *Cacafuego* in 1579; Gallo Island, where Pizarro drew the line on the sand, over which thirteen of his followers crossed; this famous round dozen believing in their leader; Gorgona, the pleasant island to which this same leader retreated after leaving Gallo, and whence he sailed to conquer Peru.¹

Entering the Bay of Panama we pass the beautiful Pearl Islands, which have been well described as a perfumed archipelago, lying like baskets of flowers on the tranquil surface of the ocean. To the eastward lies the Gulf of San Miguel, where Balboa, after a journey of twenty-five days across swamps, rivers, and woods, which had never been passed but by the straggling Indian, took possession of the Pacific Ocean in the name of the King of Spain and the Indies. Memories of old times and scenes are a little running away with me, but there is really a great advantage in being able to keep close to these shores, for not only is the current favourable in the passage to Panama, but as it is a branch of the cold Peruvian Stream, a pleasanter temperature is enjoyed than when farther from the coast.

I must, however, in justice, observe that rains are at all times frequent, and that our trip should be so timed as to pass this coast in the fine season when, as old Dampier says, "the rains are more moderate than in the wet season, for then it pours as out of sieve."

Pausing at Panama, let us reflect upon the advantage to English commerce of continuing the survey (so well begun, by Sir Henry Kellett between Panama and Guayaquil) from Guayaquil to Cape Pillar at the entrance of the Strait of Magellan. The trade of this part of South

¹ Mr. Clements Markham, in his "Reports on the Discovery of Peru," published by the Haklart Society, believes sixteen to be the correct number, including the pilot Ruiz, who returned to Panama to obtain another vessel.

America has increased in a marvellous manner, through the great revolution which the introduction of steam has made in the system of transport of goods by sea. The enterprise of the Pacific Steam Navigation Company has diverted the trade from the Isthmus of Panama towards the natural channel of the Strait of Magellan. So successful has been this new current of trade, travel, and commerce, that the Company's fleet of magnificent steamships barely suffices to meet the demands of the extraordinarily developed commerce of the South Pacific.

In a statement of the steam companies engaged in the trade of the Pacific Coast, from a Report made by the Statistical Office of the Republic of Chile, Valparaiso, 16th September, 1874, we read as follows:—Pacific Steam Navigation Company, 56 steamers; South American Steamship Company (native line), 10 ditto; German, "Kosmos," 6 ditto; Belgian, 4 ditto; White Star Line, 4 ditto; Compagnie Générale Transatlantique, 3 ditto;—total, 83 steamers. The steamships of the first-named company made 45 voyages from Liverpool and back, the gross receipts being stated at three million dollars for cargo; nearly 2,000,000 dollars for passenger-, and 120,000 dollars for postal-service. Altogether 524 voyages on the coast, and 124 to Europe were made by the various steamers enumerated. This year the depression in financial centres has led to some of the above lines being withdrawn from the trade on this coast, and the Pacific Steam Navigation Company have largely reduced the number of steamers employed on their line *viâ* the Straits of Magellan, the sailings now being fortnightly in lieu of the weekly service carried on last year.

The annual cost of carrying on the survey of the coast of South America would, I believe, be about £14,000 a year, a little less than you willingly allow to be spent on some experiment in shipbuilding that may, or may not succeed; while of the success of this survey, there can be no doubt, for not only would you be constructing charts for the benefit of the mercantile navy; but, as I shall presently show, you would be establishing a first-class finishing school, which, in giving your Naval Officers the opportunity of putting into practice what they had learned at Greenwich, would enable them more efficiently to protect the trade they were helping to create. From the praiseworthy efforts which the Chilean Government are now making to improve our charts of their coasts, I feel sure of their assistance and co-operation in this work. They would be only too glad to send their Officers to school in our vessels, and thus, after a few years, we should be able to carry out the dream of a political economist and "let the Chileans survey "their own coasts."¹

Looking northward from Panama, there is much work to be done. The rising trade of the Central American ports calls for more attention to coasts, of which, when to the northward of the Gulf of Fonseca, we have little information since the days of Malaspina in 1794. I am glad to be able to state that during January we received American

¹ In the "United Service Gazette," of 30th January, it was stated that the Naval Department of the Chilean Government had organised three hydrographical explorations on the coast of Chili.

surveys of the coast and Gulf of California which will enable me to shade those shores.

In the North Pacific Ocean, that centre of commerce, the Sandwich Island group, is, I regret to have to point out, unshaded. Our chart of that group is said to be "from various but imperfect authorities." Captain James Cook who, considering his short stay, gave us, in 1778-9, a good exploration; and the United States exploring expedition in 1841, added to our knowledge of this archipelago. Something better is, however, required in 1874.

But I must push on from Panama, or we shall not get round the world to-night. From Panama, we shape our course for Tahiti; passing the Galapagos, which may be considered as sufficiently well surveyed for the time, we come next to the Low Archipelago in which the three symbols are blended. What is first wanted here is to examine certain tracks which ships are likely to follow in their passage from Panama, or Valparaiso, through these dangerous patches of coral. The comfort such a road would give to the sailor is something beyond a landsman's understanding. Leaving the beautiful and famous Tahiti, where you will all remember Captain James Cook observed the Transit of Venus in 1769, we pass on through the Friendly Islands and Fiji archipelago. Here reliable charts are much wanted to clear away the doubtful dangers of this part of the Pacific, which render the nights of the captain as uncomfortable as those of a parish doctor in a poor neighbourhood. He is always being called, has to turn in all standing, which means in plain English, going to bed in his boots.

Many of my hearers will remember the graphic account of the discomforts of shipwreck among the Fijis given by the Earl and the Doctor. Their schooner was, I think, wrecked near the Exploring Isles in the eastern part of the group.

Commodore Goodenough, ably assisted by his industrious Navigating Officer, Lieutenant Hosken, is doing his best to improve our charts of this archipelago; but his praiseworthy efforts show only too clearly how much a surveying vessel is required in Melanesia.

Refreshing ourselves at Sydney, we next push northwards for Hong Kong; our course lies through portions of the ocean similar to those we have already passed; our charts of this part of the world may be said to be, in a great measure, supported by voluntary contributions. Captain Simpson and Navigating-Lieutenant Greet, in the "Blanche"; Navigating-Lieutenant Tilly, of the mission schooner "Southern Cross"; and lately Captain John Moresby and his navigator, Lieutenant Mourylian, have all sent additions to our charts. Captain Moresby has been very energetic on our behalf,—obtaining first the services of Navigating-Lieutenant Conner, of the Queensland Survey, and latterly those of Lieutenant Dawson, our itinerant surveyor of the south-western Pacific;—he has been enabled, through these Officers, to forward considerable information regarding the shores of New Guinea; following up the discoveries of Bougainville and Dentrecasteaux, Captain Moresby has charted about 300 miles of the hitherto almost unknown western coast of this island, and has made important additions to the Admiralty charts. Notwithstanding, however, the

efforts of these worthy contributors, our captain's anxieties are not decreased, and it is not until we get to the northward of the Carolines that he can, for a season, divest himself of his boots.

Our passage is now more free from dangers. Passing through the Bashee Channel, we enter the China Seas, refreshing ourselves at Hong Kong. Leaving that port, we observe an absence of shade to the eastward, and traders between Hong Kong and Sydney would be grateful for better charts of the Mindoro Straits and the passages through the Philippine Islands. Coaling at Singapore, we hear that merchantmen are asking for better charts of the Carimata Strait and the Java Sea.

Entering the Indian Ocean, by the Straits of Malacca, our next port will be Point de Galle. I will here pause to thank Mr. Clements Markham for calling attention, in his Magazine of July last, to the state of the Coasts of India, little having been done to the charts of this important portion of our dominions since 1862, when the Indian Navy ceased to exist; and the charts, copper-plates, and original drawings were transferred to the Admiralty. Mr. Markham tells us "it was suggested, but not agreed to, that the future surveys of the "Indian Coasts should be conducted by the Royal Navy." The very few surveying ships that the Admiralty were allowed to equip had other work to do, the Imperial Treasury having no intention of paying for Indian surveys.

You will be pleased to hear that Lord Salisbury has here come to our assistance, and that a surveying force, consisting of five sailing vessels taken from the marine service at Bombay and Calcutta, will at once be established. Each sailing vessel will be supplied with a steam pinnace, and there will be one steam tender; the flotilla will be officered by one Staff-Commander, three Navigating-Lieutenants, two Navigating Sub-Lieutenants, with Mr. R. C. Carrington, late first-class draughtsman of the Hydrographic Department, as Chief Civil Assistant. This force has been organized by, and will be placed under the superintendence of a well-known Indian Officer, Commander A. D. Taylor, who will do his best to restore the efficiency of the old Indian Marine Surveys, and make provision for the fast-increasing commercial necessities of British India.

From Galle we proceed to Aden, and up the Red Sea. I regret being unable to mark the shores of this sea with the dark line. A beginning has, however, been made; Captain Nares has surveyed the Gulf of Suez, and Lieutenant Gray the small Strait of Bab-el-man-deb; but I have little doubt the trade through the Suez Canal will enforce this work. Thanks to Monsieur Lesseps, we need not leave our vessel, but may steam into the Mediterranean where, not to weary you further, we will land at Brindisi and ruminate over what we have seen and heard. This voyage round the world will have given you an idea of how much is required to be done. We will next consider who there is to do it.

I fear if I pipe "Chart-makers to muster," there will hardly be sufficient for the work, especially if we look to the main line of the Navy, where only two Captains, one Commander, and two Lieutenants

can be found who may be called qualified to command surveying ships. The Retired Lists would add some four or five Officers to our forces, but I fear their services are no longer available. In addition to these Officers, there are nine Staff-Commanders and three Navigating-Lieutenants, who may also be in some measure qualified; for it must be remarked that, it having for some time past been considered expedient not to give Navigating Officers the command of surveying ships, they can be employed only as leaders of detached parties. Their instructions are to charter small craft in the colonies, and, with a hired crew and one or two assistants, work round the little circle of which their head-quarters is the centre.

This detached system chiefly recommends itself by its cheapness, and as an auxiliary force is, I admit, not without value; but it tends to isolate the Surveying Service from the general service, and naturally inclines the Officers connected with it, to feel *colonial* rather than *imperial* interests.

Another disadvantage of these detached parties is, that we lose that grand school for practical nautical surveying, viz., a ship and the disciplined life of a man-of-war, where alone a young Officer can acquire the combined knowledge requisite to qualify him for a profession in which the duties of the *sailor* can by no means be neglected. No man can expect to attain a trusted position as a Nautical Surveyor who is not essentially a good Officer and sailor, or, to speak more exactly, a good Pilot, knowing how to handle a body of men, the requirements of a ship, and the room she wants to wear, stay, or anchor in. This knowledge cannot be acquired in, what a naval paper has well termed, "the one-man-and-a-boy system" of nautical surveying.

It was with great regret, therefore, that, in the middle of 1873, men, like Sir Bartle Frere, who took an interest in this important branch of the Navy, saw it had fallen so low that there was only one regular surveying ship in commission, viz., the "Shearwater," under Commander Wharton, then on her passage from the survey of Sicily to assist in the Zanzibar expedition.

The "Challenger," Captain Nares, was, it is true, also in commission; but she must be looked upon rather as an exploring than as a surveying vessel; at the same time, under Captain Nares, and his indefatigable Chief of the Staff, Staff-Commander Tizard, a school was formed from which the best results may be expected,

The total number of Officers employed at this time, July, 1873, was, including the "Challenger's," 36, of whom four only belonged to the main branch of the service, i.e., there were only one Captain, one Commander, and two Lieutenants among the number.

Let us now go back for a quarter of a century, to 1849, the days of Sir Francis Beaufort, when the public took a greater interest in the Surveying Service. We find that there were no fewer than 12 surveying vessels in *commission*, in addition to 23 Officers, borne on ships' books for detached Surveying Service.¹ At the same time the Arctic

¹ If in 1819 a full list of "Officers employed on surveying service" had been

force (the "Challenger" or additional scientific force of the period), numbered three ships, exclusive of the "Erebus" and "Terror."

I have here a list of Captains and Commanders, who in 1849 might have been considered qualified to have taken charge of a survey. The number is a large one, viz., 17 Captains and 12 Commanders: as the names are tolerably well known, I think reading the list will interest many of my hearers.

Captains.	Commanders.	Surveying Ships of 1849.
Barnett.	Bate.	"Acheron."
Bayfield.	Bedford.	"Arion."
Belcher.	Drury.	"Bramble."
Beechey.	Frazer.	"Columbia."
Bullock.	Orlebar.	"Comet."
Collinson.	Nolloth.	"Herald."
Denham.	Otter.	"Pandora."
FitzRoy.	Richards.	"Rattlesnake."
Graves.	Shortland.	"Royalist."
Kellett.	Spratt.	"Scorpion."
Owen.	Williams.	"Sparrow."
Sheringham.	Wolfe.	"Volage."
Stanley.		
Stokes.		
Sulivan.		
Vidal.		
Washington.		

It will be observed that I have given a list of Captains and Commanders only, omitting the Lieutenants and Masters employed in 1849; many of whom were also qualified to command surveying ships.

I have taken 1849 by chance. I am not sure that it was a year in which the Surveying Service was in a particularly flourishing state: 1873 was a bad year, the minimum was arrived at of *one ship*; a fact, cruel enough to arouse the shade of Sir Francis Beaufort; and it is easy to imagine that veteran Surveyor upbraiding his countrymen, and saying, with Cæsar Augustus, "Oh, Varus, restore me my legions."

I will next proceed to show that these ships of 1849, as schools, produced not only Nautical Surveyors, but superior Officers for the general service.

Take the "Acheron," commanded by Captain John Lort Stokes, then surveying New Zealand; in this same "Acheron," the late Hydrographer, Admiral G. H. Richards, was Commander, and Chief of the Staff; the present Hydrographer, Captain Evans, was the Master, and his present Chief Naval Assistant, Staff Commander Pender, a Master's Assistant.

The Captain of the "Encounter," Richard Bradshaw, the Officer at first especially selected to take the observers for the coming Transit of Venus, to Kerguelen Island, was also a Midshipman in the "Acheron."

given, similar to the one in the present Navy List, it would have included upwards of 80 names.

Take the "Herald," then, with the "Pandora," surveying the great Bight of Panama, under Captain Kellett and Lieutenant James Wood. The Captain of the "Herald" is now Sir Henry Kellett, K.C.B., lately Commander-in-Chief on the important China station.

I may here remark that the present Commander-in-Chief in China, Sir Charles Shadwell, K.C.B., Fellow of the Royal Society, was First Lieutenant of the "Fly," Captain Sir F. Blackwood, during the survey of the east coast of Australia and Torres Straits; while Admiral Ryder, the future Commander-in-Chief in China, received his early education as a sailor and navigator under Captain Richard Owen, in the "Thunder," the surveying ship in the West Indian station in 1833.

Returning to the "Herald," her First Lieutenant was Rochfort Maguire, who finished his career as Commodore of the Australian station. The Second Lieutenant commanded one of the Arctic ships in 1853. The Master of the "Herald," after leaving that ship, served as Master of Sir George Seymour's flagship in the West Indies. Of the Midshipmen, one died as Captain in charge of an Australian Survey, one has lately retired after commanding two surveying ships in succession; another is Captain Bedford Pim, who I am pleased to find on becoming M.P. has by no means ceased to be R.N., or forgotten his nine years' service in H.M. Surveying Service; and last and not least of the old "Herald's," is the humble individual who has the honour to address you, then a Master's Assistant, now Superintendent of Admiralty Charts.

I have taken two instances only out of the surveying vessels of 1849; I am sure that most of them would tell a similar tale. Sir John Glover, of Ashantee fame, was serving about that time as a Mate on board the "Volage," then surveying in the Mediterranean.

There is another interesting branch of the profession of Nautical Surveying, which becomes of the greatest value to our merchants in this age of submarine cables; I allude to deep sea soundings, and to an examination of the bed of the ocean for the purpose of laying those useful communicators. On the 1st of June last year, at a meeting of the Royal Geographical Society, the wall of the theatre of the London University was covered with diagrams, showing how much work the "Challenger" had done in deep-sea sounding. Great was Lord Howe's victory of the 1st of June, 1794 (a day never to be forgotten by the English sailor), and the memory of the day was well kept in 1874, by exhibiting the trophies of a victory over the elements of which Captain Nares may no less be proud. By the diagrams Dr. Carpenter illustrated an instructive paper, and I believe, proved the correctness of some of his ingenious theories.

Many of you know the care, forethought, and experience required in "overcoming the mechanical difficulties" of obtaining an accurate deep-sea sounding. Sounding was ever a most important point in a sailor's profession. Upon the accuracy of the soundings engraved on the Admiralty chart, the character of the Nautical Surveyor mainly

A phrase used by some of our philosophers, who, although knowing a few of the secrets, cannot be said to comprehend the mystery of the sea.

depends, for while the land work may be done by the soldier or civil engineer, the sounding is the sailor's portion, requiring all the ready wit and tact of his profession. In sounding, the sailor has to manage air and water, the rise and fall of the tides, the velocity of currents, and to fit in his work to suit wind and weather; these forces becoming firm allies to the man who studies them, and foes only to him who knows not how to use them.

Readers of Marryat will remember the Master of the old war time was often called "Soundings" by his shipmates. The name might not have been meant as a compliment, but it nevertheless was so. This prime duty of a Nautical Surveyor is now of more value than ever. Telegraphic Engineers not only require accurate position and depth of water, but also samples of the bottom of the sea at great depths, they want to know what kind of bed their cables are to lie upon, and this information can be obtained only by sounding.

I am glad to observe that the part of Sir Bartle Frere's letter, showing the advantages of an expedition to the Arctic seas, has been attended to. The fact of our last Arctic Expeditions having brought to the front such men as McClure, McClintock, Maguire, Richards, Osborn, Armstrong, and Nares of the "Challenger," may lead us to hope that the present attempt to place the Union Jack on the northern meeting of the meridians, may bring into notice another body of English sailors, who shall worthily fill the place of those now passing away, and I feel sure none will ever regret again raising the cry of "Northward Ho!"

But there is one more point I should like to call your attention to, and that is to another body of men the Surveying Service has brought into notice; a class that many (and probably with good reason) would esteem more highly than the simple sailor; I allude to naturalists and botanists; and when I assert that such men as Darwin, Hooker, and Huxley, began their celebrated careers in Her Majesty's surveying and exploring vessels, I hope the public will think it worth while to restore the old practice of appointing a naturalist to surveying ships, on the chance of securing men of such undoubted value to the scientific world.

Professor Wyville Thomson's staff, now qualifying themselves for these important duties by sea service in Her Majesty's ship "Challenger," leads us to hope that the surveying vessels of the future will carry a naturalist, as in the days of Sir Francis Beaufort; and I was much pleased to observe in Captain Taylor's scheme for re-establishing the Indian surveys, that he pointed out the advisability of again appointing to every surveying vessel a Medical Officer, who is also a naturalist, and giving him encouragement and opportunity to pursue his scientific tastes.

I trust, Sir, that I have now fully proved the correctness of the assertions of Sir Bartle Frere, in his letter to Mr. Gladstone, viz.: "That there are few better schools than a Surveying ship; and that if such ships were multiplied, not only would commerce benefit, but our men-of-war would be better supplied with practical seamen."

We have now considered what may be termed the out-door work of the Surveying Service. We must next turn to the in-door portion.

The harvest may be plentiful, the labourers hardworking and willing, the corn is cut and stored, but before we can use it for food, it must be threshed, ground, and made into bread. As with corn so it is with nautical surveying. The work comes home, it has then to be given to the world in the shape of Admiralty charts.

This distribution of knowledge is placed in the hands of the Hydrographic Office of the Admiralty, which unfortunately, through the rigorous system of economy insisted upon by the public, has not been permitted to advance with the times.

The number of charts increases yearly, the work required is more finished and elaborate, the demand and sale of the charts also increases, but there is no corresponding increase in the Staff employed. In the beginning of 1874 the Office suffered two considerable losses, the late Hydrographer, Admiral Richards, being carried off to the chair of the Telegraph Maintenance Company; while the Japanese Government induced one of our best draughtsmen (holding through the present rules of the Civil Service, with regard to age, a junior appointment, but who had actually served four years in the Scottish Survey, and ten years at the Hydrographic Office), to leave £150 per annum in England for £1,000 per annum in Japan. At the end of the year, we also lost our first class draughtsman, whom Captain Taylor persuaded to join the Indian Marine Survey; as, however, this loss to us will be gain to India, we can console ourselves by knowing that Mr. Carrington is only serving the Indian instead of the Imperial Government.

Without entering into the general work of the Hydrographic Office, I will venture to make a few remarks upon the particular and important branch of the Department over which I have the honour to preside.

The old surveyors, who are present, will, I think, quite understand the mingled feelings of pride and diffidence which I experienced last year when (on the death of my much lamented predecessor, Captain Hoskyn, who may fairly be said to have died at his post) Admiral Richards placed me as Superintendent of Admiralty Charts in the chair once occupied by Michael Walker. The difficulties before me were not so much to improve the present, as to be equal to the past.

I found myself most ably supported by the gentlemen of the Admiralty Chart-Room, or room in which the charts are prepared for publication; but until I had fairly entered upon my new duties, I had failed to realize the maximum of work which this branch of the Office had managed to perform, with a minimum of hands.

An inspection of the Admiralty Chart-Room would prove the truth of the assertion of the *Daily News* in January, 1873, that "space is wanted to spread out a chart, without having first to remove books or papers that are at the same time under consideration." The place is rather suggestive of a midshipman's chest, and it is only from a sailor's luck of having been educated in a midshipman's berth and used in thus

"being cabined, cribbed, confined," to utilize every atom of space, that one is able to cope with this difficulty.

The number of charts at present published by the Admiralty is in round numbers 2,500, a large number of which are continually under correction, for changes in lights and buoys, alterations in leading marks, *i.e.*, beacons, natural or artificial, that lead through channels to clear submarine dangers.

These corrections, although small, require the greatest care and experience to make them; for if such *important simplicities* are neglected, and the chart be incorrect in these essentials, no finish or cunning engraving can save its credit; it is beauty without discretion, a danger "instead of a safeguard to the sailor who uses it. "Any draughtsman," says Sir Edward Belcher, "can make a neat showy plan, but it is useless if it cannot stand the seamen's test." As a very slight error in the position, colour, and character of a light or buoy, or in the insertion of a simple dot, cross, or figure may lead to the gravest disasters, every mark upon an Admiralty chart must be delineated by the Hydrographic Draughtsmen with the greatest care, and no pains are spared by these gentlemen in their endeavour to attain—where it is possible—mathematical exactness, and to lay before the public the labours of the nautical surveyors, explorers, and amateurs, not only of England, but of the civilized world; reducing their various styles into a comprehensive system, and thus furnishing the intelligent seamen with an intelligent guide, which common industry will soon enable him to thoroughly appreciate.

For instance, there are no fewer than 3,710 lighthouses and light-vessels in the world; these lighthouses and light-vessels are generally surrounded by, what we will term for illustration, a large family of buoys. Let us take a well-known place, "the Downs," or speaking of watering-places, that part of the coast of England between Broadstairs and Dover. Here we have 3 lighthouses, 4 light-vessels, and about 20 buoys, or nearly 3 buoys to one light; from this we may premise that there are considerably over 9,000 buoys that have to be inserted upon the Admiralty charts.

Notices of changes in lights and buoys abroad require careful translation by some one who not only understands the language, but also the subject under consideration. Here we miss the talented draughtsman before-mentioned, who, in addition to his other qualifications, was also a surveyor and an accomplished linguist.

Again, copper plates, when much used, actually wear out; 4,000 impressions taken from the same plate in four years is a trial even for copper. On an average, it may be stated that, allowing for each plate the constitutional three score and ten years, no less a number than 36 plates a year have to be re-drawn and re-engraved to keep up the stock. In addition to the above, new surveys require new plates; these average from 40 to 50 a year, making a total of about 80 fresh plates that are required yearly.

Sir Bartle Frere's address of 1874 informed the Royal Geographical Society that during the past year 77 new charts had been engraved and published; 1,620 sheets had received corrections and additions; and

the number of charts printed for the Royal and Mercantile Navies and use of the world had been 187,248.

All MSS. and published hydrographic matter received from foreign Governments has to be examined and compared with the published charts, to see if they can be improved therefrom; and in this duty alone considerable labour and experience are required.

The above constitutes an amount of work which the present staff of a chief draughtsman and five assistants, is not equal to, and the result is, that the unpublished information is steadily accumulating.

It may now be asked, "But what will the new College at Greenwich do for us?" This question will, I am sure, be answered to your satisfaction this day fortnight, when my friend Mr. Laughton will read us a paper on the outline of the studies at the Royal Naval College. My own experience, as an Examiner in Nautical Surveying at the College, encourages me to hope that it will recollect that it is educating men who are to be sailors themselves, and direct the labours of other sailors. Greenwich cannot educate the whole Navy, it can but select those Officers best fitted to make use of the advantages it offers. In those men, the College aims at developing the keenest intellectual insight, readiness, and strength, *but*—and there is as much virtue in this *but* as in Touchstone's *if*—*but* I say not (in the case of Surveyors) at the expense of their fingers.

Charts have to be projected or built. Our Surveyors will do this more craftily and swiftly, and with more delicacy and precision, with the help of higher mathematics; but a wildness of $x + y$ will not assist a man who cannot use scale and compasses. Greenwich, therefore, while aiming at the highest, forgets not the lowest.

Emerson, commenting on the success of Napoleon, points out in how great a degree it was due, to his never thinking the smallest detail unworthy of the most careful consideration; he could draw up an attractive A B C for the King of Rome, as well as the orders for a score of brigades. "It is a five minutes," said the Emperor, "that wins a battle."

Darwin, himself a sailor, somewhere remarks that, as a man's intellect increases, his instinct decreases. Sailors must not be educated so highly that they lose those instincts which are the real cause of our naval supremacy. Remember that the success of the sailor and pilot depends upon a thorough and *ready* knowledge of the many important simplicities of his calling; such knowledge necessarily endows him with that promptness in action, and fearlessness in conduct, for which members of his profession have ever been distinguished.

The public must remember that while the Greenwich students are acquiring the valuable power of handling books and instruments, they should not lose the not merely valuable, but absolutely invaluable power of handling men and ships. Modern theorists seem to have forgotten that the great use of education is to enable man or woman to earn their living honestly in that station on board the ship of life, unto which the Great Commander-in-Chief has seen fit to call them. A sailor's education, more than any other, requires *time*. The late Head

Master of Rugby, and present Bishop of Exeter, Dr. Temple, speaking with large experience as a schoolmaster, remarks, "that the indispensable condition of success in self-culture is *time*"; but it is just this condition which is most signally wanting in modern education. The student of our day must almost of necessity acquire knowledge in a hurry, bolt it in fact (a bad process for mind as for body). He must learn much, not in order to retain it and make it (to again quote the Bishop) "part of his understanding," but in order that he may be able to throw it up, when under the ordeal of the examination room.

The College will furnish the understanding of its students with arms, but its labours will be thrown away unless the country gives the students a ship in which they can exercise those arms. The knowledge acquired at Greenwich is a force to be used at sea.

You have Greenwich ashore; to complete the business you must have Greenwich afloat. No occasion to build a ship; there are plenty at hand; take a vessel like the "Endymion," remove a few guns to give space for a chart room; call her the "Greenwich," and send her to sea with her seniors drawn from the College, her youngsters from the "Britannia" (possibly it might be advisable to send the youngsters to the "Greenwich" before the "Britannia").

Let her be commanded by some general service man, in whom might be found the united qualifications of sailor, navigator, and gunner, with a staff composed of a known Nautical Surveyor, and two assistants. Send her to work at some blank portion of the Unsurveyed World, say—the Pacific. The Fiji or Sandwich Islands will form a healthy field for her labours, the passage out affording time for the usual drills, for, as before remarked, the duties of the sailor and gunner must by no means be neglected. Under the good Providence she would return in some five years time, not only with a cargo of charts, but with men, who in becoming professors had not ceased to be sailors. For it is in ships only that men can discover the "Secrets of the sea," and it is not with an egotistical, but with a self-reliant spirit that I quote Longfellow, and maintain, when speaking of the sea, that—

"Only those who brave its dangers
Comprehend its mystery!"¹

"Ships for sailors" must be the cry of our New Greenwich. Let us learn from a well-known character, Mr. Wackford Squeers, of Do-the-Boy's Hall, who, when he had taught a boy to spell "window" after his own peculiar fashion, viz., "w-i-n, win; d-e-r, der; wind~~e~~r," at once dispatched him to go and clean it, this he termed the "practical" mode of teaching, the regular education system."

Do not, therefore, fall astern of Do-the-Boy's Hall, but when your sailors have learnt the theory of Nautical Surveying, give them a well-

Specimen of the Ideas of Men who do not Comprehend its Mystery: cut from a weekly paper.

"A suggestion is made to establish telegraph cable stations on the high seas, built upon buoys, at which a steamer may stop and communicate if in distress, give in her time, and enable her passengers to communicate with their friends on either shore."

found, and well-manned, man-of-war to go and practise it, by making charts of some portion of the Unsurveyed World.

I have thus endeavoured, in the best language I can command, to set before you the present wants not only of Her Majesty's Surveying Service, but of the mercantile world, and ask you to bestow upon this service a little care, attention, and money you give so freely to ship-building and experiments therein, and great gun-founding; for let ships and guns be perfection, they are useless unless you have skilled men and trustworthy charts, to conduct your floating castles with confidence and security.

In conclusion, I appeal to many in this theatre who are fortunate enough to possess the ear of the public, and beg of them, if this paper has found favour in their sight to assist in establishing, on its proper footing, a service not alone useful in peace, but also terrible in war. The old Napoleon's collection of maps was probably the best then in existence; with these and his compasses he planned the destruction of the Austrian forces, and what he had warily conceived in the Tuileries, he executed in the field with the celerity and force of a thunderbolt. Similarly, the success of Naval operations often depends upon the correctness of the charts, coupled with the power the sailor may possess of constructing and using them.

I would, therefore, call attention to the necessity of giving Naval Officers early opportunities of putting into practice afloat what they have learned on shore; doing, it may be said, at Ansterlitz what they have planned in Paris.

Finally, I entreat you all to let this branch of Her Majesty's Service be so well recognized, as a useful element in the Empire, that it shall be in some measure protected from those blasts of ruinous economy which periodically sweep over our country; remembering that, from its first establishment, the Surveying Service has been "*second to none*" in placing and maintaining the Navy of Great Britain in its prominent position among the forces of civilization.

The CHAIRMAN: Before I call upon you to join with me in returning thanks, I have no doubt there are many gentlemen here who would like to make some observations upon the interesting paper we have just heard. Captain Shortland, I believe, is present.

Captain SHORTLAND, R.N.: Our lecturer has said what he has to say so extremely well that there is very little to be added. We surveyors know the difficulties that Officers, who are called upon to survey, have to contend with. They do not generally have the best ships given them, nor are their labours so well understood by those who have not followed surveying as by those who have, like our worthy chairman and myself perhaps. We know that we have fallen very much behind-hand lately in the numbers that have been employed, and the encouragement given to us has not been very great as far as my experience goes. I hope that the people in power, taking up our worthy lecturer's paper, will carry out some of his views and bestow a little more attention to a subject that so well deserves their best consideration. I quite believe that surveying ought not to be *departmental*, but it ought to be considered *national*. It concerns the whole nation that we should have good charts, especially as our commerce is so very large and is extending every day. If our merchants understood that, it would be the best mode of lessening the insurance on their ships, and I do hope this will be understood in order that the House of Commons may be impressed with the necessity of expending a little more money on works which are

so useful and essential. However, all I have said is so obvious to everyone, that it is hardly necessary for me to say it.

Lieutenant STIFFE, late Indian Navy : I wish, in the first place, to bear testimony to the great ability and knowledge of the subject shown by Captain Hull, and to the trouble he must have taken in getting up that chart. I think, also, the thanks of the public are due to him for drawing attention to the very important subject of the deficient state of our knowledge. For several reasons, lately, hydrography has been at a discount, and it has really seemed to me that the race of hydrographic surveyors was going to become extinct altogether. The chief countries that have had to do with hydrography have been England, France, and America. Since the civil war in America, there has been very little done there. In France there has been also a collapse during the last few years, owing to the war; and, in England, although the difficulties have only been financial, yet that has apparently been as effectual as any other cause, and we have come down it seems, at one time, to one surveying ship, which is rather an unpleasant state of things to contemplate. I would also mention the abolition of the Indian Navy, to which I had the honour to belong, and the dispersion of the trained group of men that belonged to the surveying branch of that service, has also added to the deficiency. We may hope a new era is going to dawn now, and that a House of Commons, more liberal in the true sense, will see the propriety of taking a fresh start in this matter, and enabling England to maintain her proud position at the head of nautical affairs, and rule the deep with lines of soundings in addition to other methods. Of course, unless the public can be got to understand, clearly, and take an interest in the subject, which can only be done in some such way as drawing up such a map as this, it is hopeless to expect any improvement in the matter. I have no doubt many outsiders, on looking at this map, will be rather astonished to see so much *brown* in the map.¹ Doubtless they may have formed an idea that all our maps and charts were models of perfection and completeness, and that everything in print must be correct; and, therefore, they will be surprised that so much remains to be done. But I must confess that on looking at it, to me it is perfectly astonishing there is so much *red* there; when one thinks that hydrography and charts on the present system are a thing people now living can almost recollect the beginning of. The last half century, I suppose, is nearly the whole period, and when one thinks what an expenditure of time, energy, labour, money, and life, even one of our charts often represents, it is perfectly astonishing that so much has been done. The field is obviously very large, and I have no doubt when we have finished the *brown* that is shown there, we shall have to begin again, for the increasing demands of hydrography will necessitate new and more elaborate surveys.

There is one subject Captain Hull has felt obliged to treat very tenderly, namely, the indoor department of the Hydrographic Office. We know it is difficult for a man to complain of the shoe that pinches himself, and it is not much liked. Perhaps an outsider may say something plainer, and I will say that I think the amount of space allotted to the Hydrographic Department of the Admiralty is utterly inadequate to the demand, and is unworthy of a country like this. I must say the first time I went there, 12 or 14 years ago, and was shown into the Chart-Room, I came to the conclusion that there must be suites of rooms, elsewhere, that were not shown to the public, and certainly began to institute a comparison with a private civil engineer's drafting office near Great George Street, where I was then employed, not at all to the advantage of the Admiralty Chart-Room. I must say, how the gentlemen in that department manage to find anything, spread it out for use, or put it away again, is quite a puzzle to me. It must be the result of bringing up from childhood in that office, or I do not see how it is to be done. I think it must be admitted that a large increase in the staff is a *sine quâ non*. There are, Captain Hull states, about 2,500 charts now in use; I should like to know what the percentage of increase is on what the number was 10 or 20 years ago, and what is the comparative increase of the staff to work these charts. When one thinks that the charts of the whole world are manipu-

¹ On the chart exhibited at the lecture, those parts of the world that had only been explored were coloured *brown*; the fairly surveyed portions were coloured *red*; and the partially surveyed, *blue*.

lated and repaired in that small room, it is marvellous how the work is got through at all.

Mr. FORDE: I had hoped I should have been allowed to listen to this interesting paper and discussion without having to speak myself, as I am not very much given to it; but I assure you, being connected very much as I am with submarine telegraphs all over the world, I have listened to this paper with the greatest pleasure, and I hope the result of it will be good for us engineers. We are often called upon to lay cables from one part of the world to another almost at a moment's notice, and the first thing we have to do is to rush off to the Hydrographer's Department to know what information they have as regards the locality in question. In 1861 I was engineer to Her Majesty's Government for a line laid from Malta to Alexandria. Admiral Washington was, at that time, Hydrographer to the Admiralty, and we got the charts from him. They looked exceedingly nice; and, as Admiralty charts usually are, very correct, we had come to the conclusion that we should lay this cable along the coast so as to have it within reasonable depths, as some of the former cables had been lost in deep water. We found, as I have just said, the charts exceedingly pretty, and we imagined that they were very carefully done. I was asked by the Board of Trade to write out instructions for the Hydrographer's Department to have soundings taken, in order to make quite sure of the depths and nature of the bottom, and in order to obtain soundings at much closer intervals than what is usual on Admiralty charts. The Admiralty undertook to make these soundings, and we waited some time for them. I then waited on Admiral Washington and asked him, "Have not you some soundings for us?" He said "Yes, we have some, but the information is so incorrect, I dare not send it to you." He sent out orders, in the first instance, to Commander Mansell of the "Firefly," then stationed at Alexandria, and he said his soundings were so incorrect, or, at all events, they disagreed so with published charts, that he had telegraphed to Captain Spratt, commanding Her Majesty's ship "Medina," to go and take these soundings. In due course, Captain Spratt sent home his first soundings, when Admiral Washington informed us that they confirmed those of Commander Mansell, and disagreed entirely with the published charts of that coast; in fact Captain Spratt found great discrepancies. Where the charts represented the soundings to deepen gradually from the coast into the Mediterranean, Captain Spratt found they were more like steps of stairs, going down 100 fathoms in the swing of a ship. He spent some time over this, and took partial soundings along the coast from Alexandria to Tripoli, and thence to Malta. I went to Malta to see him, and he told me he had finished that service of four soundings. On examining the charts I told him I wanted a great many more soundings, to which he replied that my request could not be complied with, as he had already burnt too much of Her Majesty's coals in the service of the Company; but when it was explained to him that this was a Government cable, he then saw the propriety of burning more coal, and started off again for the coast, and continued his work for several months longer. It appears to me that the blue colour, on the diagram, is due to Captain Spratt's services on this occasion. One thing occurred to me at that time, and I happened to mention it to the Commander-in-Chief at Malta (Admiral Sir William Martin), and that was seeing there were so many of Her Majesty's ships sailing all over the world, why cannot it be managed to have a sounding taken by each ship at noon; and, in that way, we should soon see the whole globe covered with valuable soundings; which soundings would be more or less a guide to engineers who have to carry out these long cables through deep water. But his answer to that was, "a deep-sea sounding, as we all know, requires to be taken by a man who has had great experience in the matter, and who has been well trained to it, otherwise you get false results." Now Captain Hull's paper clearly shows that the nursery for bringing up Officers to surveying has almost been destroyed, therefore we are not likely to have Officers, on board each man-of-war, that are trained to surveying and taking deep-sea soundings. I think, myself, each man of war ought to carry an Officer who has been trained in the Surveying Service, just as they would a gunnery lieutenant. I only hope that this paper may not only be brought to the notice of the Lords of the Admiralty, but that they should, if possible, read, mark, learn, and inwardly digest it, with a view to their carrying into effect Captain Hull's valuable suggestions. The "Challenger,"

no doubt, is doing good service, and will give us a great amount of valuable information both as to the deep-sea soundings and currents, as well as the nature of the bottom. I will only add that this paper is particularly interesting to us as civil engineers engaged in laying cables, and I for one, heartily thank Captain Hull for bringing the subject forward.

Mr. LAUGHLIN: I have taken such great interest in the subject of surveying for some time past, that it was with great gratification I learned that Captain Hull was going to bring it forward; it is one to whose needs I am quite sure the country is not awake. If a copy of the chart now before us could in any way be published, as in the fly-sheet of the "Times," the country would be aghast. People look at the beautiful maps issued by Keith Johnstone, and others, and they think that we know the world perfectly: what more can be wanted? They do not know that the outlines given on such maps are to a great extent mere guess-work; the proportion of what is real knowledge and of what is imagination is not known even by well educated men. I most sincerely hope the Government may be able to take the matter up, and that Parliament may find them the means to do so. In our small way at Greenwich I think we shall, in course of time, be able to give a foundation. It is not much we can do with such an entirely practical subject as surveying; but still we can give them the A B C of it, and that we are doing,—I believe, very effectually.

Dr. HIRST, F.R.S.: It was not my intention, Sir, to make any remarks this evening, because I really did not expect to be able to attend your meeting. I have listened with very great pleasure to the paper just read by Captain Hull, and I have naturally been greatly interested in the allusions he has made to the part which Greenwich may play in improving the Surveying Service of the country. There is, I think, but one observation in Captain Hull's address with which I do not heartily concur. His warning against our educating Naval Officers at Greenwich is, I submit, scarcely called for at present. If you take into consideration the small amount of an Officer's time which, under the most favourable circumstances, can be passed at Greenwich, you will, I think, admit—Mr. Darwin would certainly do so—that his sailor instincts are in little danger of being thereby diminished by over-education. Moreover, if you had been in my position this afternoon, Sir, and had seen Captain Johnson's class operating with their sextants and other instruments within the railings of Greenwich College, fixing the positions of gravel walks, by means of angles subtended by lamp-posts: if you had seen these Officers afterwards in their class-rooms laying down said walks and lamp-posts on paper, constructing, in fact, a chart with as great care as if the safety of their instructors, when traversing the Quadrangle on a foggy day, depended upon the accuracy of their work; if you had seen this, I say, you would agree with me that at Greenwich we do not at all neglect those simplicities of a surveyor's work to which Captain Hull has very properly directed attention. We certainly do not attempt to rival "Mr. Squeers" in his mode of imparting a practical training. We do not fall astern of him, however, in the matter of window-spelling, but we look mainly to the Admiralty to provide opportunities for window-cleaning. I believe, Sir, that the studies pursued at Greenwich are without exception those with which every practical man, properly so called, ought to be thoroughly acquainted. I believe that without the intellectual and theoretical training which we endeavour to give, the action of a practical man would be incessantly hampered, and not unfrequently misdirected. I have, therefore, no hesitation in pronouncing all fears as to the character and tendency of the studies pursued by Naval Officers at Greenwich to be perfectly groundless. At the same time, however, I entirely concur with Captain Hull in the opinion that our work at Greenwich requires supplementing in the manner he has advocated. Operations conducted in the Quadrangle, and even extended by means of the "Arrow," and our steam launch to a short distance down the Thames are, of course, insufficient to make a surveyor. To this end the wider experiences which a surveying ship alone can provide are absolutely indispensable. The praiseworthy efforts of our students to master the rudiments of Nautical Surveying at Greenwich, deserve more recognition by the Admiralty than they have as yet received. Such recognition, in the form of speedy employment in surveying ships, would not only be of great service to the College, but would be welcomed by all who are interested in the welfare of our

Surveying Service. We have no less than forty Officers, including Captains, Commanders, Lieutenants, and Navigating Lieutenants, now studying Nautical Surveying under the guidance of Captain Johnson. Last Session we had about twenty such students, and Captain Hull, who was their Examiner last June, was able to report very favourably of their proficiency. At the head of the list stood Commander Grey, an Officer who has well qualified himself for surveying duties, and who will, I trust, soon be actively employed in such. In conclusion, Sir, I may state that I cordially join in the wish, to which expression has been so frequently given this evening, that the Admiralty may be induced speedily to raise our Surveying Service to the high rank it formerly held.

CLEMENTS MARKHAM, Esq., C.B., F.R.S.: I, like the rest of the company, have listened with very great interest to Captain Hull's suggestive paper. I cannot help feeling that it may prove to be a turning point; that there is reason to think, from various causes, that the surveying branch of the Naval Service has at last reached its lowest depression, and it certainly will be a very great satisfaction to Captain Hull if hereafter, from this year, perhaps from this evening, we may date the gradual increase of the efficiency of the Surveying Service of the Navy of this country. In the meanwhile other countries are doing a little here and there: and I should like to be allowed to ask, if it is not an improper question, whether, whilst we are neglecting the work that used to be done on a much larger scale twenty years ago, there is any regular system of collecting from other countries all the surveying work which is done, sometimes good and sometimes indifferent, in small patches and in numerous parts of the world. This kind of work occasionally comes to my knowledge, and I have often wondered whether, as a matter of course and regularity, it was received at the Hydrographer's Office. For there is what appeared to me a beautiful little survey of the intricate channels between the Island of Chiloe and the main land. I know of another survey on the coast of Peru, executed the other day. It seems to me that increasingly valuable additions may be made to the charts, by carefully collecting everything that is done by other countries. I see, with some surprise, the whole of the West Coast of South America coloured brown. I fancied that the chart-sheets of that coast were prepared by Admiral Fitzroy, and that it would have received a blue colour. If this is not so, I can conceive no more important work than the completion of the whole of that West Coast by a regular survey, for nearly every small part on it is visited by English steamers. There was one lost only the other day to the north of Callao. Certainly numerous anchorages and bays, which no one would ever have dreamed of entering thirty years ago, are now constantly used owing to the increasing trade in sugar, cotton, and other exports of Peru. I remember myself taking a small vessel into one of the ports of which there was no sign in the chart. There is another part of the chart that shows, I think, too much red, which I think should be reduced. India has no right to have the red completely round her shores, because there are several little bits here and there unconnected, and there ought to have been brown spots in at least three places. A very distinguished civil servant of India recently told me he had, near Cape Comorin, himself opened a cotton port and despatched a ship direct to England from a place entirely unsurveyed, and unknown as an anchorage. I should like very much to see Captain Hull's chart reproduced in large numbers, because very few people can have an idea of the immense tract of coast that is untouched. I certainly had not. I fancied I should have seen the whole of that coast of South America, as examined by Fitzroy, in red; but I only see patches here and there. I am sure we ought to be extremely obliged to Captain Hull for the information he has imparted to us.

Captain DAVIS, R.N.: As an old surveyor myself, and having been employed on the survey of the coast of Peru, under the late Admiral Fitzroy, I can quite understand why Captain Hull has fixed a brown mark round that portion of the coast that I was engaged on. I consider the survey made of that part of the coast by Admiral Fitzroy to have been nothing more than a pilot-survey—a survey of the greatest utility in his day, when such ports as Mr. Markham has instanced were not even thought of as being of any importance. Admiral Fitzroy pointed them all out in a simple running survey, so that I would not at all make the assertion that the

whole of that coast was properly surveyed. Still, I think Captain Hull might put in a little bit more red.

MR. TRELAWNY SAUNDERS: I wish to add one word with reference to a practical consequence arising from the breaking up, or almost entire breaking up, of such an establishment as that which was carried on with great success under Admiral Beaufort, and that is the dispersion of a considerable body of trained artisans employed in the engraving of the charts. A body like that is not easily trained; it takes many years of apprenticeship to train them up to the execution of a work of such excellent character as those charts were; and I must say, when one compares the charts of the present day with the charts executed by Admiral Beaufort, I am afraid we must consider that there has been a decline in the art of engraving as represented by the Admiralty charts, rather than an advance. I am quite sure that whenever a very considerable increase may take place in the staff of surveyors, and there is an endeavour to turn to account the large stores of information that remain unused in the Admiralty, a very considerable difficulty will be found in procuring competent engravers, and that is one of the consequences of the economy that has been practised of recent years in the reduction of this important establishment. I think, Sir, before economies are practised in such a way as to disperse trained artisans, the consequences of such economies ought to be calculated and foreseen.

Captain HULL: With regard to the remark by Mr. Forde about the soundings not being found to agree in the Mediterranean, I may say, the soundings he alluded to were done in the days of Admiral Smyth, the great amount of coast explored being creditable to the Admiral, but it was, as Captain Davis has very well remarked, a pilot survey. I have no doubt the soundings of Captain Spratt and, I think, Captain Mansell, will be found to have the advantage of being taken by better trained men, who were able to devote more time to the work.

With regard to what Mr. Markham says of the coast from Callao, I think the work of Admiral Fitzroy's was of a similar character, and in going over it with the assistance of my friend Mr. Powell, the chief draughtsman, we came to the conclusion that, although we should have liked to colour it blue, *i.e.*, "partially surveyed," in justice we were obliged to make it brown, or "only explored."

I had not the least idea of making any attack on the Royal Naval College at Greenwich. I am quite certain the College is moving in the right direction. The remarks in my paper were rather directed towards the British public; I fancied from one or two remarks I had heard lately they were expecting too much from Greenwich; and, with regard to my allusion to Mr. Squeers, I brought him in as a sort of laugh at the public. If Greenwich taught its students to spell "window," or surveying ship, Greenwich could do no more. The public should then find the "window," or ship, to clean or survey in.

With regard to India, Mr. Markham said some part of India was not so well surveyed. I coloured that part of the chart with the assistance of Captain Taylor and Lieutenant Stiffe. Unfortunately I had never been in India myself, but I shall recollect Mr. Markham's remarks, and, when I prepare the chart for the Journal, I will take care that the part referred to shall be amended.

The Falkland Islands were done by Admiral Sullivan. They are very well surveyed, and I think are equal to the wants of the times.

As to the River Plate, portions of that river are surveyed, but they are unconnected. The river has never been fairly surveyed throughout.

THE CHAIRMAN: I am sure you will join with me in saying we have had a most interesting lecture, and before asking you to return thanks, I will just make one or two observations. We all are very well aware that the Battle of the Nile never could have been fought at the hour it was, if Nelson had not himself been a pilot. We are also well aware, at Copenhagen he took his own soundings; and, by being able to take his ships in to a close position to the batteries, compelled the result of the action there. I could quote several other Officers, Beaufort, for instance, who, in the course of the war, surveyed Karamania; Heywood, who surveyed the River Plate; but I will allude to one very celebrated Officer. A few years ago I had occasion to consult the charts of Spitzbergen at the Admiralty, and I came upon one, the last publication, corrected and improved by Captain Brook of the "Shannon." Now these are instances I have brought forward especially to call

the attention of the junior Officers, that a knowledge of surveying, in all probability, may materially influence their career through life.

I now would proceed in a few words to allude to the great benefit which the naval and mercantile service derived from the career of Admiral Sir Francis Beaufort as hydrographer. The magnitude of the ignorance was enormous, but, fortunately, we had a man who was equal to the occasion. Under his fostering care, the Officers in the list which was read to you to-night were educated and well brought up, looking to him for his countenance, advice, and support, and always being welcomed back by him with that kindness and affection which is the true source of confidence between employer and employed. I will just allude to these places which are now marked as you see them. My first passage round Cape Horn was in the month of March, fifty years ago, but then I had nothing to do with longitudes. In the year 1827 I arrived at Rio Janeiro with twelve chronometers on board the ship, and we fancied we had fixed the longitude. We returned in another vessel in the year 1835, and we were quietly informed that we were 14 miles in error. Afterwards we went round Cape Horn and tried to carry the longitude up into the Pacific. Our chronometers all went wrong, although we had twenty, and the fact of the matter was that the longitude of the West Coast of South America was not correctly fixed, I suppose, until steamers began to run in 1858. In the course of that voyage one of our objects was to settle the question of the longitude of Mount St. Elias. We sailed from Mazatlan, went up to Cook's Inlet, in lat. 60° N., and returned back to Mazatlan, although we had twenty chronometers, we brought our longitude back to 15 miles in error. That will give you an idea of the difficulty of ascertaining longitudes by chronometers, unless you perform voyages to and fro. In 1840 we found the Island of Chusan 30 miles out in longitude; and, having occasion in 1848, to compare the charts at the mouth of the Hooghly, I found the longitude of the entrance, to that river, 8 miles in error. That will give you an idea of the magnitude of the errors in those days, and what a great amount has been done since that period, and which we mainly owe to the persevering efforts of Sir Francis Beaufort. Captain Hull alluded to the survey in South America on which I was employed, and spoke about the difficulties with the rain, and told you a story about Dampier. I remember, under the same circumstances, Dampier says that it came on to rain; and, by great difficulty, they got some cocoa, but, for the life of them, they could not finish their cups, for it rained so fast.

I think now, Gentlemen, I may ask you to join with me in returning our thanks to Captain Hull for the interesting account that he has given to us, and I am sure you will cordially agree with me in thanking him for the able paper which he has written.