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"ONE HUNDRED YEARS OF MERCHANT SHIPS ON THE AUSTRALIAN COAST"

by

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ONE HUNDRED YEARS OF MERCHANT SHIPS ON THE AUSTRALIAN COAST.

PART 1. - INTRODUCTION

It is with very considerable trepidation that one embarks upon a paper on such a sweeping subject as this title suggests, and the more so because of the standing of so learned a body as The Australian Branch of the Institution of Naval Architects, London, to whose members and friends I have the honour to present it. To many, what follows will fall far short of expectations, not only because of grave personal limitations but because the implied historical side must be restricted to available time and space, and the technical features have already been covered generally in the very excellent paper presented at our parent body's centenary functions in London on 17th May 1960 by Mr. J. M. Murray, M.B.E., B.Sc., a Vice-President of the Institution and Chief Ship Surveyor to Lloyds Register of Shipping, London. Mr. Murray's paper was entitled "Merchant Ships 1860-1960" and in it he covered the whole field of British and indeed world merchant ship development.

This paper now to be presented, if such it can be called in comparison with such eminence, is intended to cover only the Australian coastal scene commencing at a time barely 72 years after Captain Phillip anchored his little ship H.M.S. "SIRIUS" in Sydney Cove. In 1860 there were no railways of consequence or any other means of communicating between coastal settlements other than by sea, and so it was by the sea that such settlements were fostered and developed. In the years of the nineteenth century and beyond indeed to the present, Australia's coastal shipping has played a great part in the country's development. The coastal shipping Companies, founded by hardy men of great enterprise must surely have their place in Australian history. Their ships carried the earlier passenger, and fuel and consumer goods when the sea was the only road over which such goods could be transported. Permanent settlement was literally carried to all corners of this vast continent on the decks of these coastal vessels. Eventually, of course, to the points which these vessels serviced went railways and roads and air services and coastal shipping, as it was at first known, began to decline, or, shall we say recede, until economic balance was reached. Such a trend is still in progress. It is a big step from the little sailing barques and paddle steamers of 1860 to the bulk carrier and drive-on drive-off ships of 1960.

In 1960 as in 1860 it surely cannot be seriously disputed that a domestic merchant marine is a necessity for Australia. The areas of intensive settlement as in 1860 are still sited on the seaboard, which being the longest of any single country continent in the world finds such settlements widely spaced. Today we find the main coal, ironstone, limestone and our only steel manufacturing industry on the coast. Moreover much of the primary production in sugar, timber and dairy products comes from areas forming a narrow coastal fringe. The material means of transporting such primary products and most of our secondary manufactured products between major Australian centres is thus naturally by the sea.

Moreover, there is the further strategic necessity for an island continent, in itself very isolated, and separated from its traditional European ancestry by Asiatic countries potentially friendly but of very different creed and mode of life, to have the ability to conduct sea traffic in independence in times of national emergency. Whilst land communications by road and rail are important and vital as the great Australian interior at last and painfully becomes developed, there are responsibilities in the Pacific which also emphasise the importance of sea transport.

The simplest of calculations reveal the advantages of sea transport. For example 3000 tons deadweight of cargo, which is the capacity of a small coastal cargo ship, is equivalent to 250 semi-trailer truck loads and 12 goods trains. Special highways are not required by ships, and terminal facilities although considerable, especially for roll-on roll-off ships, compare favourably with those of other forms of transport.

Sea ports are necessary anyway for the use of overseas ships on which we depend for national exports to world markets.

For the major part of this period under survey ownership of Australia's ships and shipping has been exclusively in the hands of private Shipping Companies, of which some thirty-four exist. However the main ones were, and generally are, the A.U.S.N. Co.Ltd., Adelaide Steamship Co.Ltd.,Australian Steamships Pty. Ltd., (Howard Smith Ltd.) McIlwraith McEacharn Ltd., Melbourne Steamship Co. Ltd. and Huddart Parker Limited. The Broken Hill Proprietary Co. Ltd. and the Colonial Sugar Refining Company Ltd. operate ships for their own requirements. However, the largest shipowner of all is now the Australian National Line, whose fleet in 1959 comprised 45% of the total. The Australian National Line is the Commonwealth Shipping Line which came into existence as the Australian Shipping Board during World War II. It operates under the terms of the Australian Coastal Shipping Commission Act 1956.

As this paper is concerned with the biggest and most representative ships, and not with Companies as such, it is restricted to interstate ships on the Australian register and owned by Companies registered in Australia. This has eliminated such important Companies as the Union Steamship Company of N.Z. and Burns Philp & Co. Ltd. Also the essentially intrastate Companies are not mentioned - of these the North Coast Steam Navigation Co. is an example of a once vital shipowner whose fleet reached a peak about 1910 and eventually fell away under competition from other forms of transport until disbanded in 1954. However, where Companies operate intrastate as well as interstate ships such as The Adelaide Steamship Co. all such ships are included.

In dealing with so wide a subject there is a great temptation to divert into avenues to do with freight rates, types of cargo and employer-employee relations. This has been resisted despite the critical importance of the last named, especially. In fact the importance of industrial relations can be judged from the fact that in 1959 in all trades average voyage accounts (reference (17)) show that Wage Costs absorbed 20.3% and Stevedoring 33.5% of the total. The technical side, represented by fuel, repairs and depreciation accounted for 23%. As the most vital part of ship maintenance is carried out for the purposes of statutory surveys, some notes are included on the background of the Navigation Act under which all ships are operated.

The century 1860 to 1960 falls logically into periods 1860 to 1875 during which only one Company still in existence was operating, but the nuclei of several others appeared. 1875-1900 during which these nuclei developed. Iron gave way to steel and the compound engine to the triple expansion engine.

1900 to 1920, following federation of the Australian States and the emergence of the specialist passenger ship.

1920 to 1945, following the proclamation of the Navigation Act and which saw the establishment of the diesel oil engine in the finest group of passenger ships yet seen on the Coast and in cargo ships.

1945 to 1960 has produced a sub-division of cargo ships into such specialised types as bulk carriers and vehicular passenger ships.

A section is included on Shipbuilding in Australia with respect to ships produced since the advent of the Australian Shipbuilding Board, Australia's authority on ship design.

Frequent reference is made to Mr. Murray's paper when considering size and speed of Australian ships in relation to world trends.

The most spectacular developments have taken place on the engineering side to do with ship propulsion.

1860 saw the compound steam engine replace the simple steam engine, and, 20 years later, be replaced by the triple expansion steam engine. The limitation imposed by the boilers began to improve with the appearance of steel to replace iron not only for shipbuilding but also for boiler-making. The Triple expansion steam engine taking steam from Scotch type boilers, coal fired by hand, with steam pressures rising gradually to about 250 p.s.i. predominated the scene for many years in cargo ships - in fact only the last decade has seen this system finally superseded by the oil engine. Powers have never really been high enough for the turbine to show its efficiency. Apart from the Bass Strait ships "LOONGANA" and "NAIRANA" it has appeared only as an exhaust turbine until the recent "LAKE" class Bulk Carriers, and several Broken Hill Pty. ships. Also two former passenger ships "ORMISTON" "ORUNGAL" were steam turbine propelled.

An important ship not mentioned hereafter and which serviced the sparse north west of Australia in the State Shipping Service of W.A. was "KOOLINDA" built in 1926 and the first oil engine driven passenger ship on the coast. A cargo ship, "MULCRA", preceded her by a year.

Although what follows is restricted to ships of the six largest Companies mainly trading interstate, the small, often one ship, Companies generally trading interstate are important because they service many out of the way places, for example King Island in Bass Strait. They are fully recorded in the Department of Shipping and Transport Shipping and Statistics Annual publication. Unfortunately some important ships are omitted by this restriction,as, for example, the passenger ships "KABBARLI" (2692 gross tons) and "KOOJARRA" (2959 gross tons) built at Newcastle in 1951 and 1956 for the State Shipping Service of W.A. They represent Australia's only venture so far into passenger ship construction (other than the passenger vehicular ferry "PRINCESS OF TASMANIA") Twin Polar engines type M45M in each ship drive the single propeller through reduction gearing and electromagnetic couplings.

Another interesting ship not elsewhere mentioned is the diesel-electric pilot vessel "WYUNA" which arrived in 1953 for the Port Phillip Pilot Service.

Irrespective of ownership and size special requirements are more and more demanding special ships. The future emphasis must be on better design, better in fact than overseas design which cannot now be expected to cover all peculiarly Australian problems as in the past. Members of The Australian Section of this great Institution have therefore have a very special responsibility in carrying on the heritage of the past one hundred years.

Part 11 - 1860-1875 Period.

A span of only fifteen years has been selected for this period because it does, in fact, represent the close of a much longer period which commenced with the formation of the first Australian Steamship Company in 1839. This Company was then the Hunter River Steam Navigation Company and is now the Australasian United Steam Navigation Company, perhaps better known as hereinafter the A.U.S.N. Company. It is necessary to go back beyond our present starting point of 1860 to 1839 when the Colony of New South Wales comprised a population of approximately 130,000 most of which was settled in the Sydney, Parramatta, Windsor, Newcastle and Hunter River districts. Although a few individual shipowners were running ships to Newcastle there was clearly a great opening for a regular service and for such purpose this Company was formed with a capital fixed at £40,000. Orders were immediately placed in England for three (3) steam paddle vessels and the first, P.S. "ROSE" (172 tons burden 146 ft. long, 19'6" beam, 11'6" depth) arrived in Sydney on 6th April 1841. She was built by Fairbairn & Co. Millwall, London on the site which later (1858) was to see launched the "GREAT EASTERN".

In 1851 the Hunter River Steam Navigation Company's name was changed to Australasian Steam Navigation Company (A.S.N. Co.) with wider scope - including routes to Brisbane and further north, and to Melbourne and Launceston in the South. Six new vessels were ordered immediately. (Reference is invited to Appendix 1A which shows a complete list of this Company's ships when our period opened in 1860.)

In fact in 1861 this Company possessed a fleet of seventeen ships (to be reduced in 1862 by the loss of "CITY OF SYDNEY" near Green Cape). In seeking a typical ship to represent this opening year 1860 the Screw Ship "WONGA WONGA" is selected. Her appearance would be striking even today. Her particulars were -

Construction	-	iron - screw steamer of 270 H.P.(nominal)
Tonnage	-	1002 gross.
		682 nett.
Length	-	242.9 feet.
Breadth	-	27.9 feet.
Depth	-	16.6 feet.
Built	-	Glasgow 1854
Speed	-	10 Knots.

Coal consumption 28 tons per day.

At the time of her arrival in Australia there was no other vessel the equal of "WONGA WONGA" in speed and appointments. She had a large spread of canvas and a hull with yacht like lines enabling her to sail as well as steam. This latter was most necessary in at least one phase of her service when chartered to run to San Francisco as her coal bunker capacity was insufficient for the great distances between Pacific ports. She was broken up in 1880 after a successful career.

Although the A.S.N. was the only Australian Company in 1860 it is necessary to mention two other important individual shipowners from whom were shortly to be established the shipping Companies known today as Howard Smith Limited and Huddart Parker Limited. At the end of 1854 Captain William Howard Smith reached Melbourne in the small screw steamer "EXPRESS", with which he subsequently operated a service between Melbourne and Geelong. His agent at Geelong was Mr. T.J.Parker, a London merchant who had arrived at Geelong in 1853 complete with an assortment of saleable merchandise and an iron store in which to display it.

The "EXPRESS" was a small iron screw steamer of 136 tons nett propelled by compound engines developing 40 H.P. She was built at Kingston Hull in 1853. She was rigged as a

schooner and used her sails as well as her engines for propulsion as did most steamers of this period including those of the Royal Navy.

"EXPRESS" was still operating in 1860, in fact she was not sold until 1874 when replaced by the "DESPATCH" - also an iron screw steamer built on the Clyde by Mr. Parker. Her nett tonnage was 267 tons. Her compound engines developed 50 H.P. Mr. Parker had by this time become an independent shipowner by purchase of a half share in "EXPRESS" in 1855. Later Captain Webb who had relieved Captain Howard Smith in command of "EXPRESS" bought out the latter's remaining half share when Captain Howard Smith, wishing to enter the inter-Colonial trade, purchased S.S. "YOU YANGS", and thus formed the Howard Smith Line in 1854.

Captain Webb and another business man, Mr. John Traill, were thus associated with Mr. Parker in the ownership of the "EXPRESS" - an ownership which in conjunction later with Captain Peter Huddart and his nephew James Huddart, became the Huddart Parker Line in 1876. Before this amalgamation James Huddart was in business in Geelong as an importer of coal and an exporter of general produce. He owned sailing ships for this purpose. They were mainly iron barques - such a one was "CONFERENCE", 399 register tons, 164.8 ft. x 26.3 ft. x15.9 ft., built in England in 1855. This ship was purchased second-hand, as was Captain Howard Smith's "YOU YANGS" of 457 tons net and 672 tons gross. Her dimensions were 185.2 ft. x 27.9 ft. x 15 ft. Her compound engine was rated at 90 H.P.

In seeking a typical ship to represent the close of this period ending 1875 one again turns to the fleet of the Australasian Steam Navigation Co. Ltd. - S.S. "WOTONGA" built in 1876 by Dennys of Dumbarton. She was an iron screw ship propelled by a compound steam engine, cylinder diameters 38" and 66". Her gross tonnage was 997 and nett tonnage 541. Her dimensions were 229.7 ft. x 29 ft. x 20 ft. She carried Lloyds 100A1 classifications, as well as other classifications.

However, although "WOTONGA" may have been expected to reflect the latest naval architectural achievement at the close of this period, the most successful ship appears to have been S.S. "CITY OF MELBOURNE", an iron screw ship of 615 tons nett 838 tons gross, built by J. & G. Thomson, Glasgow, in 1862. Her dimensions were 250.4 ft. x 28.2 ft. x 16.6 ft. She had a most handsome yacht-like appearance with a graceful clipper bow and rigged with three masts and yards on the fore-mast. She was sold in 1897.

Part 111 - 1875-1900 PERIOD.

This period is remarkable for the official creation of six of the shipping Companies well known and operating today.

The Adelaide Steamship Company was formed in 1875, Huddart Parker Pty. Ltd. in 1876, Howard Smith & Sons Pty. Ltd. in 1884, McIlwraith McEacharn Pty. Ltd. in 1885 although they were operating as Agents for overseas ships from 1875, Melbourne Steamship Company Pty. Ltd. in 1885 and James Paterson & Co. Pty. Ltd. in 1882. Also the Union Steamship Company of New Zealand was formed in 1875, a very important and interesting Company both to New Zealand and Australia but one which per force shall be omitted in favour only of Companies registered in Australia. In fact, to keep these notes within reasonable bounds, they will be confined mainly to the first three Companies mentioned above and of course the then existing A.U.S.N. Co. Ltd. to use its latest name.

The genesis of the Huddart Parker Line has already been indicated. The first fleet of colliers owned by this Company additional to Thomas Parker's ships (of which only a half interest was first acquired by the new Company) were "OLIVIA DAVIS" - a wooden barque of 523 tons net built in 1864 to dimensions 135.1 ft. x 31.2 ft. x 17 ft.
"MEDEA" a wooden barque of 423 tons net built in 1858 to dimensions 132 ft. x 28 ft. x 15.6 ft.
"QUEEN EMMA" - also a wooden barque of 314 tons net built in 1865 to dimensions 126.6 ft. x 26.2 ft. x 13.4 ft.

To this fleet of wooden barques was added in 1877 the iron barques "CONFERENCE", "FREDERICA" and "SPARROWHAWK" and another wooden barque the "RESULT" (750 ton) in 1878.

About this time the Company moved its head office to Melbourne absorbing a coal importing business. It was soon necessary to replace these little sailing ships with tonnage more appropriate to the hard service on the then poorly lighted coasts of Victoria and N.S.W. and soon appeared iron screw steamers "NEMESIS" (1393 tons gross) in 1880, "LINDUS" (1679 tons gross) in 1881 and "WENDOUREE" (1640 tons gross) in 1882. These were all propelled by compound engines which in the case of the last named ship had cylinders of 35" and 66" diameter - stroke 48" taking steam at 80 p.s.i. to give 230 H.P. Her dimensions were 273.8 ft. x 36.3 ft. x 19.3 ft. She had a cellular double bottom but no such refinement as electric lighting.

"WENDOUREE" has been selected as a turning point as about this time occurred the adoption of steel in place of iron as the hull structural material, and the triple expansion steam engine in place of compound steam engine as the main propelling unit. Such developments appeared in the same Company's S.S."BURRUMBEET" which arrived in 1885. Her dimensions were 300 ft. x 40.1 ft. x 19.7 ft. and gross tonnage 2420 tons. "BURRUMBEET" was fitted with electric light and her Scotch type boilers provided steam at 150 p.s.i. for engines 23", 33", 60" - 42" stroke developing 1600 I.H.P. She was a fine ship. In 1893 activities were extended to the Australia, New Zealand service and the steamers "TASMANIA" and "ANGLIAN" operated in this Tasman Sea Service. The latter was an iron screw steamer built in 1873 with two decks and one triple expansion engine 26", 42", 69" - 42" stroke. These ships thus commenced the service which "WANGANELLA" of the same Company now maintains. In 1875 Captain Howard Smith's trade had extended to North Queensland. In 1878 four ships were acquired of which the largest was S.S."RODONDO" 1119 tons gross. More and larger ships were acquired until in 1884 no less than 22 ships were in service and the largest of them "BURWAH", "BUNINYONG" and "GABO" had brought the firm to a point where it could no longer be handled as a private concern, and it

was registered as a Limited Company. Of these "BURWAH" appears to have been an especially proud possession. She was capable of 14½ knots and accommodated 80 passengers in contemporary luxury, as well as 1000 tons D.W. of cargo. References to her passenger accommodation include "quiet elegance" in surroundings devoid of "gaudy or meretricious ornament", and there was a "social hall". The dining saloons had chairs. The Adelaide Steamship Company was formed in 1875 and two passenger cargo steamers "SOUTH AUSTRALIAN" and "VICTORIAN" were built on the Clyde for its first services from Adelaide to Melbourne. This Company developed rapidly and after many iron ships S.S. "BARRIER" was built at Sunderland of steel. She was propelled by a triple expansion engine 21", 35", 59" by 39" stroke taking steam at 160. Her dimensions were 282 ft. x 38 ft. x 18.4 ft.

Reference Appendix 4, one is impressed with the large number of ships in service at this turn of the century. They made up a fine prosperous fleet of contemporary modern steamers.

But the closing decade of the century was a very difficult one for coastal shipping. The Hawkesbury River railway bridge was opened in May 1893 and rail fares between Sydney and Brisbane were greatly reduced (but steamer fares were still lower). Up to 1890 several companies had been operating the same route on a "joint purse" basis as, for example, on the Queensland Coast the A.U.S.N. Co. with a total gross tonnage of 21528 and Howard Smith Ltd. with 9617 gross tons total. Such agreements appeared to end about this time when all Companies on the coast entered a period of intense competition in freight and passage rates. By 1896 this price cutting war eased and in July 1899 shipowners met in Melbourne at what was the first meeting of the Australian Steamship Owners Federation. Thus a shipping federation was formed although it did not achieve its present character until about 1920. Reverting to the ships themselves in this period ending 1900, in fact for the whole period covering the latter half of the 19th century, their function was to combine the carriage of passengers and cargo. S.S."BURWAH" was mentioned as carrying 80 passengers and 1000 tons deadweight of cargo, but with some greater emphasis on passenger comfort than existed previously. This trend was prompted by competition from the Railways and we see it carried into the early 1900's with the virtual separation of cargo and passenger types of ships. Prior to the Railways competition nearly all the larger ships carried some passengers with varying degrees of comfort - for example, Howard Smith's "KEILAWARRA" an iron ship of 784 gross tons and 486 net tons, dimensions 200.2 ft. x 19.2 ft. built in 1866 was considered the last of an era of ships with cabins on a single deck and extra berths on sofas in the dining saloon which was fitted with long tables and padded forms instead of chairs. There was one bathroom for 48 passengers and one wash basin for every four berths. Then followed "KOONAWARRA" in 1880, a steel ship of 1273 gross tons dimensions 246.2 ft. x 33.5 ft. x 16.4 ft. "a fine ship" (but another single decker) "replete with all the comforts and facilities calculated to entice and satisfy passengers" (but she still followed the practice of providing sofa berths in the dining saloon).

Such were the standards accorded passengers at this time of great and restless movement to and from and between gold field centres mainly before the advent of railways. Passengers no doubt travelled for quite different reasons than in the era commencing early in the new century, and there was no emphasis on luxury, travel of any sort could hardly have been taken for recreational reasons. As was natural ship layout of the early steamships followed that of the sailing ships they were replacing. Thus they were of the flush deck

type with machinery openings protected only by low coamings and glazed skylights. The Master, Deck Officers and Passengers were berthed aft as in the sailing ships, with cabins grouped around the dining saloon. The Engineers were berthed in a house conveniently placed amidships for access to the engine room. The crew were accommodated in the forecastle space below deck, and later in a special superstructure above deck.

To accommodate more passengers an after deck house was added and this became a poop deck extending well forward to the break of the bridge. As the need arose for specialised cargo ships the long poop was not so necessary and it was eliminated or shortened, but a superstructure or a short bridge as it is called, was retained amidships to protect the engine and boiler room openings. This superstructure was convenient for accommodating officers and engineers, and with the added forecastle deck for the crew created the "two island" type of ship or more accurately the "three island" type as some sort of poop superstructure was necessary to house the steering gear and sometimes a store or hospital. Later, of course, in the next decade some of the crew were accommodated in a more pronounced poop superstructure aft, and finally all the crew were housed there as in most British cargo ships today, or amidships as in most American cargo ships. However at the turn of the century the "Three island" type of arrangement was just established and continued with scarcely any modification until the danger of forecastle accommodation in cases of collision were reflected in Governmental regulations and that space prohibited for such a purpose. A typical cargo ship of this time is S.S. "MOORABOOL" of 2996 gross tons 1947 net tons built in 1899, whereas S.S. "BURRUMBEET" already described exemplifies the long poop deck with passenger accommodation thereunder, and the raised forecastle deck for the crew.

It is indeed a matter for regret that more details have not been left for us of the ships of this latter half of the nineteenth century. They mostly complied with Lloyds rules.

Some idea of the problems which the change from sail to steam introduced may be gauged from the Cunard Line's first ship, the "BRITANNIA" which had a weight lifting capacity of 865 tons, of which 640 tons had to be coal. This problem of how to reduce the volume of fuel carried and/or increase the proportion of carrying capacity given over to payload cargo faced every shipowner contemplating steam. It is not surprising therefore that even in 1875 the Huddart Parker fleet consisted entirely of sailing barques when they decided to venture outside Port Phillip Bay.

There were, however, no sailing ships left in the fleets of the major Australian Shipping Companies by 1900. Referring to Appendix 4 the total such ships owned by A.U.S.N. Co. Ltd., Howard Smith Ltd., Huddart Parker Ltd., Adelaide Steamship Co. Ltd., McIlwraith McEacharn Ltd. and Melbourne Steamship Co. Ltd. were 21, 20, 18, 27, 9 and 5 respectively. A total of 100 ships.

Some ex-sailing ships are retained as coal lighters to the present day.

PART IV.

1900-1920 PERIOD

The turn of the century was notable for many changes in the Australian Shipping scene. Basically the main change was the result of the passing of the Constitution Act in 1900 by which interstate Customs duties were abolished. From this point under interstate free trade Australian manufacturing industries expanded at a greater rate than before and more ships were required to carry manufactured goods between the States. Another consequence was the Navigation Act of which much more will be said.

The Adelaide Steamship Company in particular heralded the new century by revising its passenger fleet. Two fast vessels "YONGALA" and "GRANTALA" arrived in Australia in 1903 and 1904 respectively. Unfortunately the former was lost in 1911, as was another passenger ship "KOOMBANAA in 1912.

In 1912 another ambitious building programme produced three more passenger ships "WARILDA", "WANDILLA" and "WILLOCHRA". The first named was torpedoed in the English Channel in 1918.

In 1920, the end of this period saw changes due to the completion of the east-west railway and the extension northwards of the Queensland coastal railways. "WANDILLA" and "WILLOCHRA" were found to be redundant and were sold. The special feature of these ships was that they were designed primarily for passengers and their comfort - the cargo side was secondary and speed was emphasised and relatively high (15 knots) Unfortunately it wasa class of ship destined to disappear in the 1920-1930 period, to be revived in even greater style in the 1930's and is now almost extinct again. There are many reasons for such instability - mainly economic and rather beyond the scope of this paper.

If thisperiod produced some fine specialised passenger ships, it also produced a specialist class of cargo ship prompted by the carriage of coal from the Newcastle coalfields to every State.

This problem of passenger ship development was repeated in all the other Companies.

In the Huddart Parker fleet we find "WESTRALIA I" appearing in 1897 - a little ahead of this period but advanced enough to be included in it. Her particulars are given in Appendix 5 and are submitted as those of a typical first class Australian passenger ship at the turn of the century.

In 1904 "WIMMERA" appeared. She was a slightly larger ship but of the same character. She was a steel ship, of course, and her Web Frames are particularly noted in the records. Her engines developed 3953 I.H.P. and produced a service speed of 14½ knots for a coal consumption of 74 tons per day. Her tons per inch immersion was 26. Her gross tonnage was 3022. Of her length of 335 feet the poop deck extended forward 200 feet and the forecastle deck ran aft 100 feet, leaving a forward break or well. "RIVERINA" followed in 1905.

In 1908 came "ULIMAROA" a larger ship of 5828 tons and of dimensions 400' " x 52'2" x 23'2" (25'10" moulded). Her T.P.I. was 40.3. Her twin engines developed 4973 I.H.P. giving a service ship speed of 13.5 knots (15 knots maximum) on a consumption early in her life of 94 tons per day rising to 105 tons per day when she was sold in 1932. In 1926 she was consuming 103 tons per day. These rising consumption figures are an important accompaniment to the rising years of a ship's life.

"ZEALANDIA II" followed in 1910 and after 31 years of splendid service was lost as a hospital ship by enemy action at Darwin in 1941. She was a little larger than "ULIMAROA" but more comfortably appointed. She was consuming 120 tons of coal per day at the end of her life. The initial figure was 105 tons per day.

In the Howard Smith fleet passenger ship additions in this period were "BOMBALA" in 1904, "COOMA" in 1908 and "CANBERRA" in 1913. The latter ship in particular was very finely fitted. To the A.U.S.N. Co-fleet passenger ship additions were "KYARRA", "KANOWNA" and "INDARRA", all fine ships, especially the latter (although reputed to be a little tender). She was the largest ship thus far seen on the coast. Her gross tonnage was 9735 and dimensions 451 ft. x 60.1 ft. x 37.4 ft. She had twin quadruple expansion engines, cylinder diameters 26½" x 38" 54" x 76" - 48" stroke taking steam from seven (7) Scotch boilers. The McIlwraith McEacharn fleet was augmented by "KAROOLA" and "KATOOMBA" and the Melbourne Steamship Company brought out "DIMBOOLA".

These nine passenger ships set quite a new standard. The later ones were requisitioned by the Admiralty during the 1914-1918 War and performed valuable service mainly as troop ships.

Technically they were orthodox enough. None had more than two decks above the freeboard deck, but what they had from "ULIMAROA" onwards at least, more continuous decks. This permitted the now familiar promenade deck with the boat deck above. Steerage accommodation was general below the long forecastle deck, and second class accommodation under the poop deck which was really the after end of the continuous shelter deck.

Their machinery was triple expansion engines, although twin four cylinder in the case of "ZEALANDIA" taking steam from numerous Scotch type boilers.

"KATOOMBA" was unique in having a triple screw driver by a turbine taking exhaust steam from the triple expansion port and starboard engines.

Whilst such passenger ships of class were appearing, many cargo ships were also being built and commissioned, mainly for the carriage of coal and for general cargo. The character of these ships did not alter much over the period. They were invariably shelter deck type with the three island type of superstructures. Triple expansion steam engines with Scotch boilers taking coal, hand fired, were economical and satisfactory. Ten (10) knots was fast enough. It was a static period technically which was a surprising feature of the 1914-1918 War. Wars usually excite men to special inventive efforts, not always the most beneficial, but this did not occur in the field of ship propulsion. The Australian cargo ship of say 1905 differed but little from that of 1920.

Perhaps the biggest difference was that in 1920 a fleet of Australian built ships produced at Walsh Island under a Government Shipbuilding Programme became available and were absorbed into the various Company fleets. Details of a typical such ship was S.S. "MILDURA", built in 1920 with a total deadweight carrying capacity of 5644 tons; her length 331 ft. breadth 47'9" loaded draught 23'9" gross tonnage 3359 net tonnage 1922. If these ships were imilar in design to the cargo ships of 15 years previously they were definitely bigger, and that perhaps is the most apparent trend of all as the years passed - the size of the ships increased.

Some details of Company fleets in 1920 have been extracted from Lloyds Register and are given in Appendix V . Total number of ships distributed amongst six (6) Companies was 126.

1920 has been chosen as the end of a vital period for several reasons.

(a) The great wave of passenger ships which so characterised this period ceased and very few of these fine ships survived to sail in the 1930's. This is indicated by the re-orientation which took place in the senior shipping Company- A.U.S.N. Co.Ltd. between 1920 and 1930 disposed of ten (10) passenger ships and five (5) cargo ships replacing them with two (2) passenger ships and seven (7) cargo ships.

(b) Further expansion of the Railways, especially along the Queensland coastal belt to Townsville and Cairns.

(c) Losses by war and storm.

(d) Unsettled labour conditions and consequent rising costs.

(e) The proclamation of the Australian Navigation Act.

Of these, the last named was the most important. It provided that the coastal trade should be reserved for ships on the Australian Register, i.e. ships conforming to Australian conditions and licensed to trade on the Australian Coast. It is so important that a whole section of this paper will now be devoted to it and its predecessor Navigation Acts.

PART V.

THE AUSTRALIAN NAVIGATION ACTS.

(a) BACKGROUND ENGLISH LEGISLATION.

(b) AUSTRALIAN GOVERNMENTAL CONTROL BEFORE FEDERATION.

(c) THE AUSTRALIAN NAVIGATION ACT 1912-1959 WITH PARTICULAR REFERENCE TO CLAUSE 288.

(d) ADMINISTRATION OF THE AUSTRALIAN NAVIGATION ACT.

(e) LLOYD'S REGISTER OF SHIPPING.

PART 5.

THE NAVIGATION ACTS.

(a) BACKGROUND ENGLISH LEGISLATION.

The object of the Australian Navigation Act 1912-1959 which resulted from Federation in 1900 and which has had such a profound effect on Australian shipping (due to one vital Clause 288) was, as in all such legislation, to reduce the risks of seafaring. Although a Royal Commission on the Act in 1923 stated that its purpose was to build up an Australian Mercantile Marine by protecting the Australian shipowner from unfair competition (the reason for Clause 288) in almost every other respect the Act followed previous English Acts. Therefore as background we probe back to English law, and also, most pertinent, to the Governmental administration of Australian shipping in the many years of coastal seafaring which preceded Federation.

In England, although Governmental interest in the affairs of the Merchant Marine goes far back into history the state of affairs prior to the British Mercantile Marine Act of 1850 was not very satisfactory. For example, in 1830 the system of classification at Llyods was imperfect (Lloyds Register in its present form dated from 1834); the method of measurement of ships for tonnage dues almost encouraged shipbuilders and shipowners to disregard safety in favour of economy; charts were poor; drunkeness and incompetency were all too general amongst officers and men.

A Parliamentary Committee was set up in England in 1836 and a Marine Board resulted to rectify those and other imperfections. After the inevitable opposition and delay an Act was passed in 1845 imposing the respomsibility on to the Board of Trade of approving surveyors of passenger steamers, and empowering them to enquire into accidents. The first step had been taken and a further Act followed consolidating all existing merchant shipping legislation under the Mercantile Marine Act of 1850. The years from 1850 to the turn of the century reflected much Parliamentary interest in mercantile shipping. It was indeed the glorious era of Pax Britannica and just as the white ensign flew unchallenged on every sea and in every harbour that mattered, so, under the protection of the Royal Navy, did the red ensign fly at any remote corner of the sea where business called. Hardly a year went by without at least one Act being passed concerning shipping.

In 1851 the Steam Navigation Act gave the Board of Trade the power to appoint surveyors not merely to approve them as hitherto. It also authorised the Admiralty to ensure that all vessels carry lights at sea and like requirements from which may be traced the International Collision Regulations. In 1852 an important Act was passed raising the standard of conditions in emigrant ships, but its provisions were never properly enforced. The literature contains comment that much of the voluminous legislation of the 19th century with its good intentions was often not adequately executed.

Of far reaching importance was the matter of Freeboard and Load Line which was resolved in this period. Although the name of Mr.Samuel Plimsoll, M.P.,will ever be associated with it by his agitation in 1870 (which lead to it becoming law) the matter had not been neglected by Naval Architects prior to that time .

About 1834 a Lloyds' Underwriters' Committee suggested that a freeboard should be marked on the side of each ship amidships at a distance below the deck of one quarter of the depth of the hold. Although this plan took no account of the size of the ship it was in general use until about 1880. The next suggestion was made by the Liverpool Underwriters on the doubtful principle that small ships required less freeboard than larger ships - this suggestion argued that freeboard per foot depth of hold should vary from 2¼ inches per foot depth of hold for depths of 10-12 feet, up to 4 inches per foot depth of hold for depths of 26 feet.

In 1870, after serious losses due to overloading, the Institution of Navel Architects joined the argument by suggesting that the freeboard should be one-eighth of the beam with an allowance for length; which encouraged the narrow ship so prevalent when one examines the statistics.

The solution as we know it today came from Martell, Chief Surveyor of Lloyds' Register, who advocated the principle of allowing a certain proportion of surplus buoyancy which should be fairly uniformly distributed. For example, if it was mainly concentrated aft the bow could have insufficient lifting power. Such matters were adopted in a series of tables proposed by Martell. Bernaby summarises the agruments of this time in his Historical Review of the Institution 1860 - 1960.

Suffice it here to record from O'Neil's paper that "The Merchant Shipping Act of 1875 required every British vessel to have permanently marked on her sides lines showing the position of the deck, while before she sailed in the foreign trade the owner had to mark also on the sides a circular disc of 12 inch diameter to show the maximum load line intended to be used in salt water. In 1882 Lloyds' Register issued tables for freeboard which were widely adopted on a voluntary basis, and the Board of Trade prepared corresponding rules for the guidance of their officers. In 1883 the first Load Line Committee was appointed and in its report in 1885 it accepted Lloyds rules."

With apologies for this diversion on Load Lines, a vital subject with far reaching effects on ship design, we eventually arrive at the Merchant Shipping Act 1894 - a truly great Act consolidating the maze of legislation which preceded it and which has formed the basis of every subsequent Act. A Naval Architect could surely be excused for regarding it as a classic of clarity and far-sightedness.

Before leaving the Imperial scene and return to our local one a further comment on Load Line is pertinent. One can do no better than to quote again from O'Neill's excellent paper (Bibliography Reference (b)).

"In 1903 tables of freeboard were introduced by the Germans which allowed slightly less freeboard than was authorized by the British rules. This gave rise to considerable discussion and in 1906 the position was adjusted by mutual concessions. The 1913-14 Safety of Life at Sea Conference which is referred to later in this paper, had been preceded by the appointment of a Load Line Committee, which was asked to examine the whole question of freeboard in the light of experience and to prepare rules suitable for international usage. That Committee which reported in 1915, found that the original freeboards of 1890 as modified in 1906 were reasonably sufficient, though various modifications were made in the methods of obtaining allowances to take account of various changes in the disposition of forecastle, bridges and poops/ The freeboard was now stated as a distance to be marked downwards from the deck to the centre of the disc, the length to be determined in relation to the size

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proportions and arrangements of the vessel. An international standard of strength was proposed based on dimensions and obtained by an analysis of the requirements of the principal classification societies. Particular attention was called to the vulnerability of hatches and other openings in the decks and sides of vessels.

The outbreak of the first world war put a stop to any further developments in freeboard and load line arrangements and it was not until 1930 that the whole matter was comprehensively reviewed by the International Conference on Load Line which met in that year. The Convention which emerged introduced major changes in the methods of computing freeboard and load line; it also materially tightened up the regulationa governing conditions of assignment. While here and there minor modifications may be, and indeed have been thrown up, it seems unlikely that for many years to come any fundamental alterations will be required in the principles governing the assignment of freeboards to ships."

There then is the position regarding load line. Other changes in legislation have mainly been the result of International Conferences for the Safety of Life at Sea in 1913-1914, 1929, 1948 and in this year 1960.

If one were invited to name three great maritime disasters of this century which have influenced thinking on maritime safety one must surely submit the losses of "TITANIC","MORRO CASTLE" and "ANDREA DOREA". Possibly time may permit further comment on these great tragedies, but one must hasten back to the Australian Coastal legislation prior to, at, and after Federation.

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PART 5.

THE NAVIGATION ACTS

(b) AUSTRALIAN GOVERNMENTAL CONTROL BEFORE FEDERATION

The Australian Constitution Act, which was passed on 9th July 1900 provides as follows vide Clause 98 -

> "The power of the Parliament to make laws with respect to trade and commerce extends to navigation and shipping and to railways the property of any State".

This was the Authority on which the Navigation Act 1912-1959 was designed. However, before considering it, especially its vital Clause 288, it is relevant to enquire by what instrument shipping was controlled prior to 1900 and also proclaimed the seaworthiness of ships on the Australian coast assuming correctly that they were beyond the direct control of the Board of Trade in London and its Acts and Regulations discussed at some length in the previous section.

The position was that each State Government controlled ships entering and leaving its ports and harbours. In Victoria the first reference located is "The Victorian Steam Navigation Act"of 1853. This is described in Victorian Statutes as "An Act to consolidate and award the Laws relating to Steam Navigation and to the Boats and Lights to be carried and the Signals to be made by Sea-going Vessels".

Clearly New South Wales had preceded Victoria in this matter and one of the Acts repealed had been taken over from New South Wales by earlier Victorian legislation. This is clear from Clause 1.

Under Clause II the Local Governor of Victoria was empowered to

appoint a board to be called "The Victorian Steam Navigation Board" with full power to carry out the provisions of this Act. This is now the Marine Board of Victoria and, of course, still functions with respect to intra-State vessels (such as harbour tugs) as does similar Boards in other State capitals.

In Clause V one reads that steam vessels had to be surveyed and Owners transmit a declaration to the Board twice each year.

By Clause VI Masters and Engineers were to be examined to the satisfaction of the Board and so on.

In 1865 the Victorian Parliament passed an Act entitled -

"Passenger Harbours and Navigation Act"

which consolidated the 1853 Steam Navigation Act, also the 1855 "Passengers Act " which dealt with the standards of emigrant ships arriving at the Colony. It was clearly influenced, as was all Colonial legislation, by English law and clearly the British Merchant Shipping Act of 1854 with its 1862 Amendment Act was the pattern. It was divided into seven parts nominated

Part I	Passengers
Part II	Port and Wharfage Regulations
Part III	Pilotage
Part IV	Steam Navigation
Part V	Shipping Regulations
Part VI	Enforcement and Appropriation of Penalties.
Part VII	Miscellaneous Provisions.

Under Part IV the Board had power to appoint Shipwright and Engineer Surveyors. Similar legislation existed in other States and by it all shipping was controlled until Federation when the Commonwealth Government absorbed it all except for ships restricted to local intra-State trade.

In Victoria the transfer of powers from State to Commonwealth is covered by Clause 263 of the Marine Act 1958 (the revised title of the 1853 Act.) which reads -

> "Effect of Navigation Act.
> "It is hereby declared notwithstanding anything in this Act that as on from and after the commencement (whether before or after the commencement of this Act) or any Part Division or section of or any Schedule to the Navigation Act, any provisions of this Act or any corresponding provisions enactment or of any regulations under this Act or any such enactment (so far only as such provisions are inconsistant with the Law of the Commonwealth and relate to matters within the powers of the Commonwealth) shall to the extent of the inconsistency be and be deemed to have been invalid and shall cease and be deemed to have ceased to be in operation."

PART 5.

(c) THE AUSTRALIAN NAVIGATION ACT 1912-1959 WITH PARTICULAR REFERENCE TO CLAUSE 288

The Navigation Bill which consolidated the State Marine Acts was originally drafted in 1902, and first introduced into the Senate in 1904 but it was withdrawn as in June of that year a Royal Commission was appointed to examine the proposed legislation and to report, which it did in June 1906.
In 1907 an Imperial Conference was held in London on the subject of "Merchant Shipping Legislation". This Conference comprised representatives from Britain, Australia and New Zealand and its recommendations included -

> "That the coastal trade of the Commonwealth be reserved for ships on the Australian register i.e. ships conforming to Australian conditions and licensed to trade on the Australian coast".

This vital resolution was embodied in the draft Bill which was again introduced into the Senate in 1907, but again it lapsed, to be re-introduced in 1908, again in 1910 and again in 1911. It was finally agreed by both Houses in 1912, but by the time it had received the Royal Assent, war had broken out and operation of the Act was postponed at the request of the British Government. Ultimately the first group of sections came into effect by Proclamation on 1st July 1921.
This first group of sections was Part VI, the Coasting Trade provisions, and its validity was immediately contested in the High Court where it was decided that the provisions did not apply to vessels solely engaged in the domestic trade of a State, i.e. to intra-State ships. Apparently shipowners objected to the manning and accommodation scales laid down by the Act. These objections have long since been laid aside under the effects of the above quoted recommendation which the Royal Commission explained was prompted by the desire to build up an Australian Mercantile Marine.

This desire clearly transcended all considerations of party politics, as to implement it the whole protective policy of Australia was in fact extended to its merchant shipping. In fact to protect the Australian Shipowner from competition on the Australian coast by ships of other nationalities, with lower wage scales or Government subsidy, it was thought necessary to prevent such ships competing against him unless they complied with Australian wage scales, provided the same standard of accommodation and had the same manning scale.

After so many years of consideration, the Navigation Bill and particularly this vital provision of it, can surely only be the result of -

(1) the Government realising the importance of merchant shipping to an island continent
(2) the considered necessity to build up a source of supply of skilled and trained Australian seamen against times of war, as was so amply proved when the necessity arose in 1939.

These factors were considered of sufficient importance to offset the inevitable fact that ffeights on the Australian coast must be higher than those of foreign ships manned by fewer seamen and receiving lower wages and conditions.

Such was, and still is, the price to the taxpayer of our National necessity - our Australian Mercantile Marine - because the Navigation Act 1912-1959 still contains this provision quoted thus from Section 288 -

> "(1) Subject to this Act, a ship shall not engage in the coasting trade unless licensed to do so.
>
> (2) Licences to ships to engage in the coasting trade shall be for such period, not exceeding three years, as is provided, and may be granted as prescribed.

"(3) Every licence shall be issued subject to compliance on the parts of the ship, her master, owner and agent, during such time as she is engaged in the coasting trade with the following conditions -

(a) That the seamen employed on the ship shall be paid wages in accordance with this Part of this Act; and

(b) That in the case of a foreign ship, She shall be provided with the same number of Officers and Seamen and with the same accommodation for them, as would be required if She were a British ship registered in Australia or engaged in the coasting trade ;

(c) That where a library is provided for the use of passengers, every seaman and apprentice shall - where no library for their special use is provided - be entitled to obtain books therefrom under the same conditions as may regulate the issue of such books to passengers etc.etc."

This protective Clause which appeared from the inception of the Act was not lightly accepted at the time by Australian commercial interests, especially in the less industrially developed States of Western Australia and Tasmania. The whole matter was again the cause of a further Royal Commission and its Report dated 20th August 1924 is acknowledged for much of the information contained in this section. This Royal Commission recommended that Part VI (The Coasting Trade) of the Act (containing the contentious Clause 288) be repealed.

This recommendation was not accepted, and so, since 1921, Australian shipping has enjoyed this protection from competition from ships flying other flags, even from British ships, as very few have troubled to obtain a permit to trade on the Australian coast, except some passenger ships.

To this protection can be attributed the second great wave of fine passenger ships, to be included in the next Section which started to appear with "MANUNDA's" arrival in 1928 and of which the end is in sight with only "MANOORA" and "KANIMBLA" remaining. Apparently even the absence of competition has not enabled the ships to be operated economically. Cargo ships reveal a similar trend. The whole position is admirably covered in the Tariff Board's Report on the Shipbuilding Industry dated 30th June 1959.

An attempt has been made to ascertain whether another advanced member of the British Commonwealth has fared similarly to Australia. One naturally thinks of Canada, and referring to the Canada Shipping Act 1956 Part XIII Section 671, one reads

"No foreign built British ship whether registered in Canada or elsewhere is entitled to take part in the coasting trade unless licensed for that purpose."

This provision can be traced back to the original Canadian Act which became effective on 1st September 1902.

Hence Australia is not alone in protecting its coastal shipping in this way. After all, its local competitors, rail and road transport are not threatened by similar transport operating on a lower scale of wages and conditions.

(d) ADMINISTRATION OF THE AUSTRALIAN NAVIGATION ACT.

The administration of the Australian Navigation Act is in the hands of the Minister for Shipping and Transport. His department is known in the industry for short by its original title - the "Navigation Department." At its head in Melbourne is the Director of Navigation, and in each State he is represented by a Deputy Director of Navigation. Under each Deputy Director is a Regional Nautical Surveyor and a Regional Engineer Surveyor who are responsible for the periodic survey of all ships to comply with currant Regulations under the Navigation Act and the consequent issue of Certificates. Each Shipping Company has a Marine Superintendent and an Engineer Superintendent (sometimes one Superintendent combines both functions) who are thus responsible both to the Director of Navigation and to his Company for the compliance with the Navigation Act of all ships operated by his Company. Thus Superintendents, or Ships' Husbands as was their old title, have the unenviable task of ensuring that the ships are seaworthy, safe and properly officered on the one hand, and operated with the maximum economy and efficiency on the other hand. Theirs is often a very tenuous path to tread.

It is unthinkable not to append to any Note on the administration of the Navigation Act a reference to Lloyds' Register of Shipping which has played such a vital part in the development of the merchant ship.

Reference is therefore invited to Section 20CN of the Navigation Act quoted as follows :-

"CERTIFICATES REQUIRED BY CARGO STEAMSHIPS ON INTERNATIONAL VOYAGES.

"The master or owner of a cargo ship registered in Australia, being a ship of five hundred tons or more gross registered tonnage, shall not take the ship to sea, or permit the ship to be taken to sea, on an international voyage from a port in Australia unless there is in force in respect of the ship a safety certificate or a qualified safety certificate or

(a) a safety equipment certificate
or a qualified safety equipment certificate
(b) a certificate of survey or a classification certificate
and (c) a safety radiotelegraphy certificate etc."

The important sub-clause is (b) which exempts a cargo ship from a safety certificate if it has a safety equipment certificate (issued only by the Navigation Department to cover such matters as life saving and fire protection equipment and cargo handling equipment) and a classification certificate.

Turning back to the Interpretation clause 187A of the Act we read that a "classification certificate means a classification certificate of a prescribed standard issued by a prescribed corporation or association for the survey and registry of ships"

Now the only prescribed corporation or association so far approved is Lloyds' Register of Ships . An alternative possibility which has been discussed is the great French corporation Bureau Veritas, but so far the only such exempting authority is Lloyds. This, of course, only applies to cargo ships. For Passenger ships only the Navigation Department's safety certificate is valid, but for insurance reasons ships are invariably still classified at Lloyds. Hence two Survey Authorities have to be satisfied.

(e) LLOYD'S REGISTER OF SHIPPING SOCIETY.

The history of Lloyd's Register of Shipping is a long and fascinating one, and can farily easily be read, especially in this its bi-centenary year when a special publication has been issued about it. (Bibliography Reference (8). As far as Australia is concerned, however, the first Surveyor was appointed in 1872. He was resident in Sydney on a "non-exclusive" basis, i.e. he was not employed solely by the Society. In 1900 twelve Surveyors covered Australia, Tasmania and New Zealand. Now, in 1960, a staff of twenty-four Surveyors covers Australia, whilst New Zealand has its own organisation.

In 1950 an Australian National Committee was set up, which is one of ten such bodies set up throughout the world at major shipbuilding centres. Such a Committee is made up of local shipping executives and its object is to guide the Society's efforts in the country concerned. This Committee has the right to send a representative to the Technical Committee in London, and so local Shipowners and Shipbuilders have a voice in the technical decision of the Society.

The increase in the activities of Lloyds Register in Australia is very much concerned with the increase in shipbuilding activities as one of the essential functions of the Society is the laying down of shipbuilding standards and approving their application. In fact, the practical detailed design of a merchant ship is done almost entirely from Lloyds "Rules and Regulations for the Construction and Classification of Steel ships", a remarkable publication which is brought up to date annually. These rules are a veritable mine of information based not only on fundamental calculations, but also on statistical results of their application to ships classed with Lloyds. In 1959-60 the total number of ships so classed is 10995 amounting to 53,000,000 tons gross, which is about one half of the world's merchant fleet. The other half would be classed with other national classification Societies, for example Bureau Veritas (French), American Record (U.S.A.), Noske Veritas (Norwegian), Germanischer Lloyd (German), Registro Italiano Navale et Aeronautics (Italian) etc.

In Australia, as already stated, none to date save Lloyds are recognised as exempting the hull and machinery survey of cargo ships.

In seeking therefore, a definition of Lloyds Register of Shipping quotation is made from Lloyds Calendar 1960 page 243

> "This Society founded in 1760 and reconstituted in 1834, was established for the purpose of obtaining for the use of Merchants, Shipowners and Underwriters, a faithful and accurate classification of merchant shipping for the government of which Rules and Regulations have from time to time been adopted.
>
> The Register Book, printed annually, contains the names, classes and other useful particulars relating to ships classed by the Society, it also includes , as far as possible similar details of all other sea-going merchant ships of the world of 100 tons and upwards."

It will be noted that the Society exists to help Underwriters amongst others. It is not itself an underwriting body although it often is confused with the Corporation of Lloyds Underwriters which is a Corporation of Underwriters quite separate from Lloyds Register. The Underwriting Corporation has agents throughout the world also with no connection with the local Lloyds Register surveyors. These Agents are known as Lloyds Agents and when say a ship is damaged and a claim on Lloyds Underwriters is indicated, it is Lloyds Agent who is contacted and who arranges for survey and report to London.

P A R T VI

THE PERIOD 1920 - 1945

Despite the protective measures contained in the Navigation Act described in the last part, new tonnage was slow in appearing during the first decade of this 1920-1945 period. Considerable adjustment was required to the economic impacts of the 1914-1918 war, although to those who lived through the 1939-1945 war and its aftermath, they appear comparatively mild. However it was an unhappy precedent when the A.U.S.N. Company's first post-war ship "MACKARRA" was found to cost in 1919 £133,841 whereas "MALLINA" about the same deadweight capacity of 4000 tons built in 1909 cost £66,681. This basic fact added to the competition from the railways undoubtedly produced a shrinkage in the fleet. As already mentioned between 1920 and 1929 the A.U.S.N. Co. disposed of ten (10) passenger ships and five (5) cargo ships. The replacements were "MAREEBA" and "MILDURA", two Australian Government built "E" class vessels - "MILORA", "MARANOA", "MURADA" and "MUNGANA" all acquired in 1926 were also standard Government built vessels - "BARALABA" in 1925 - "ORMISTON" and "ORUNGAL" passenger ships (ex. "FAMARA" and "FEZARA") in 1927. Other pre-Second War ships acquired were "BINGERA" in 1935 followed by "BABINDA" in 1936 and "BURANDA" and "CORINDA" in 1937. Of these, the last, M.V. "CORINDA" was the first large motor ship in the Company and a very fine one indeed. After war service with the British Fleet Train she is still actively employed in the Coast. Her tonnages are 3376 gross and 4922 deadweight. Other particulars are 345.6 ft. x 48.3 ft. x 21 ft. longitudinally framed at bottom and at deck.

Of the passenger ships "ORMISTON" and "ORUNGAL" the former was sold in 1954 and the latter wrecked in 1941. Both were propelled by single screw steam turbines taking steam from oil fired Scotch boilers.

Like most turbine plants of about this power (4000 S.H.P.) the economy left something to be desired. Similarly the Adelaide Steamship Company acquired cargo tonnage during the 1920 years without any replacement of its several passenger ship losses until the very fine and modern T.S.M.V. "MANUNDA" arrived in 1929. Of the cargo ships we saw "ALDINGA" arrive in 1920, a single deck ship of tonnages 3078 gross and 5145 total D.W. capacity, burning 28 tons of coal per day for 10 knots (little better than a similar ship built in 1900!) She was in fact a sister ship to "AROONA". Other coal burning steamships of about this size were acquired over the next few years including two Government built "D" class ships "DUNDULA" and "DILGA".

The really progressive step, however, was taken when this Company ordered three motor ships from Burmeister & Wain of Copenhagen. These were "MULORA","MOMBA" and "MUNDOO" - a fourth, the "MUNDALLA" followed. These were the pioneer motorships on the coast. They paved the way for "MANUNDA" with their highly successful four stroke single acting blast injection heavy oil engines of Burmeister and Wain design and construction.

The Adelaide Steamship Company celebrated its jubilee in 1925 when its fleet consisted of 49 steam and motor vessels totalling 79088 gross tons.

Undeterred by the experiences enjoyed or otherwise by the Union S.S. Co. with "AORANGI" and her four diesel oil

engines ("AORANGI" was the first motor passenger ship in the world) the Adelaide Steamship Co. re-entered the passenger service as stated in 1928 with "MANUNDA" - a beautiful vessel surpassed probably only by "MANOORA" and "KANIMBLA" in 1936. "MANUNDA" was sold in 1956. "MANOORA" is still in service. Both ships were part of the second great wave of Australian luxury passenger ships now almost extinct as only "MANOORA" and "KANIMBLA" have survived, and there have been no replacements for others yet to be named. Apart from being a little larger (10856 gross tons, compared with 9115 gross tons for "MANUNDA"), the "MANOORA" differs mainly in her Burmeister and Wain engines operating on the four stroke Airless Injection Principle. This is a great advance on the Air or Blast Injection Principle which was the best available to "MANUNDA" in 1929. These two ships are so well known in Naval as well as Merchant Service circles that no attempt will be made to describe them. They both were, and "MANOORA" still is in world class for this type and size of passenger ship.

The closing pre-second war years saw the Adelaide Company, and also Huddart Parker Ltd., building a fine class of single deck cargo ship in Scotland. This is the class comprising "BUNGAREE", "BUNDALEER", "BELTANA", "BAROSSA", and Huddart Parker's "BARWON".

"BAROSSA" might be taken as typical of this class planned essentially for bulk cargoes but not unsuitable for lighter general cargoes except for the absence of between decks, so necessary where space rather than weight lifting is the aim. As most ships of the class are still operating we can speak of them in the present tense. "BAROSSA"'s dimensions are 367 ft. b.p. x 50.3 ft. x 27 ft. 3 in. depth moulded and tonnages 4265 gross 2225 nett 5600 D.W. Superstructures on their single deck are Poop and bridge 147 ft. long and forecastle 43 ft. long. The engines are triple expansion with cylinder diameters 20½" - 33" - 54" - 42" stroke with a Bauer-Wach arrangement of exhaust turbine coupled to the single propellor shaft through double reduction gearing and an hydraulic coupling by which the turbine is disconnected when astern operation is required as it then cannot contribute power. Steam is supplied by two single ended Scotch boilers at a pressure of 220 p.s.i. with moderate superheat and forced draught. Originally designed for coal firing several of the class have been converted to oil fuel firing with generally satisfactory results.

These ships can be considered the most advanced cargo ships of the pre-second world war period, but even on oil fuel they can hardly expect to compete with the motorships which followed them. They represent a compromise to those who would go too far to improve the steam reciprocating engine power plant at the expense of complication which is never welcome in a mercantile fleet for which reliability is the prime consideration. Scotch type boilers have proved cheaper to maintain than the water tube boilers in say "ADELONG". The Andrews & Cameron (main engine) valve gear with superheated steam has proved its worth, but the exhaust turbines have tended to be a disappointment. As a class the ships are underpowered, 10 knots is not fast enough in 1960 unless it can be maintained under all conditions.

In Howard Smith (Australian Steamship Pty. Ltd.) circles the re-orientation of the post-war cargo fleet followed the same pattern as in the A.U.S.N. and Adelaide Steamship Company fleets but on a smaller scale because that Company, sensitive to the restless industrial conditions which began with the 1917 Railway strike in N.S.W., diverted capital away from shipping to other industries. No passenger ship was to

replace "CANBERRA" which resumed her passenger running but was sold in 1947 - coal fired steam plants were no match for the motorships which by then were well established.

From 1921 the only fleet additions were cargo ships built with emphasis on capacity, convenience and economy of operation rather than on speed (which always means much more fuel pro rata).

"CYCLE II" 6730 tons D.W. and "ERA" 5350 tons D.W. were acquired in 1921 and "AGE II" in 1923. "DROMANA" 5608 tons D.W. a Government ship was purchased in 1927 amongst several other cargo ships. A gap followed then until 1936 when, in more settled industrial conditions, "AGE III" 6310 tons D.W. was built - she is especially fitted for self-trimming and grab discharge of bulk cargoes.

"CYCLE III" 3952 tons gross in 1939 was the last pre-second war addition to the fleet.

In the Huddart Parker fleet two passenger motor ships and two cargo steam ships were added in this period. "WESTRALIA II" and "WANGANELLA" are also well known in naval as in mercantile circles. "WESTRALIA II" arrived in 1929 and operated in the Sydney - Fremantle passenger service, except for two spells of Naval Service, until March 1959 when operations had become so unprofitable that she had to be sold. Her particulars were dimensions 431.1 ft. x 60.2 ft. x 28 ft. tonnages 8108 gross 4717 net. She was propelled by two eight cylinder Burmeister and Wain engines each developing 4000 I.H.P. at 110 R.P.M. They operated on the four cycle single acting principle, naturally aspirated with blast or air injection of the fuel.

"WANGANELLA", arrived in 1932 - although completed in 1930 as "ACHIMOTA" for the Elder Dempster Line. "WANGANELLA" is still actively engaged in the Australia - New Zealand passenger service. She is a somewhat larger ship than was "WESTRALIA", her dimensions being 461.2 ft. x 63.9 ft. x 29.1 ft. and tonnages 9576 gross 5625 net. Her engines are similar to "WESTRALIA'S" except they are supercharged by means of the Buchi exhaust gas turbine blower system. They were also initially operated on the (blast) air injection principle until 1957 when they were converted to operate on the Airless (or solid) injection principle. The change has been very successful. The combined fuel pumps and fuel valves were manufactured by Messrs. Wilson and Kyle of London to operate on the Archaeloff Principle by which high pressure gas is lead from the cylinder on the compression stroke and used to operate the fuel pump. The obvious saving is the elimination of the three-stage air compressor which was previously direct coupled to the engine from which it absorbed about 8% of the engine power to generate air at 900 p.s.i. by which the oil fuel was injected or blasted into the cylinder.

The cargo ships acquired included the S.S."BARWON" in 1939 - the last of the "BAROSSA" class. Her Scotch type boilers were converted from coal to oil fuel firing in 1957. This has been a successful conversion the oil fuel consumption being 18 tons per day compared with 33 tons of coal per day previously. Unfortunately the power of these ships leaves something to be desired - the engine indicates 1500 equivalent to about 1400 at the shaft which the exhaust turbine boosts to about 1750 S.H.P. The boilers are fitted with superheaters in the fire tubes and these are not as efficient on oil firing as on coal, consequently the steam is wetter by the time it is exhausted from the L.P. cylinder into the turbine where blading troubles are more prevalent than formerly.

The other Huddart Parker cargo ship acquired was "ADELONG" in 1936. She is especially mentioned not only because she is still running, having also been converted to oil fuel firing in 1957, but she reflects some interesting attempts of the 1930's to improve the triple expansion steam engine under the growing competition from the diesel oil engine. Hence in "ADELONG" we find two watertube boilers of the Babcock and Wilcox Cross drum type. The steam pressure is still only 250 p.s.i. but it is superheated by about 150°F. before passing to the triple expansion engine fitted, as is "BARWON", with Andrews and Cameron poppet valve gear on the high pressure cylinder, but unlike "BARWON" she has no exhaust turbine (and is considered the better ship without it). The two auxiliary electric generating engines are steam impulse turbines operating on the de Laval principle at 10,000 R.P.M. driving each 600 K.W. generator at 300 R.P.M. Originally, the ship's galley was fitted with an electric stove but this was replaced by an oil fuel one at the oil fuel conversion of the boilers in 1957. Experience has proved that for this type of power plant developing about 1800 S.H.P. Scotch boilers and slower speed reciprocating engine driven generators would have been more economical.

Such was the general opinion on the coast. Undoubtedly matters could be improved in the triple expansion steam engine and Scotch boiler (or watertube boiler) arrangement, but at the cost of simplicity and subsequent maintenance. The diesel oil engine was soon to take over at this 2,000 S.H.P. power level as it had already done in the 10,000 S.H.P. passenger ship installations.

Other fine passenger ships to appear in this period were "DUNTROON" (Melbourne Steamship Company) in 1935 and "KANIMBLA" (McIlwraith McEacharn) in 1936. "DUNTROON" finished her service in 1959, but "KANIMBLA" is still operating.

Opinions will naturally differ as to the most beautiful ship to be seen on the Australian Coast. The writer only submits "KANIMBLA" now in her 25th year as worthy of such a title.

Her dimensions are 468.8 ft. x 66.3 ft. x 30.2 ft. and tonnages 10985 gross 6585 net. She is propelled by twin Burmeister and Wain engines of similar design to other passenger ships of the 1930 years except, as with "MANOORA", the oil fuel has been mechanically (i.e. airlessly) injected from the outset. These engines also operate on the single acting principle as did those of the other passenger ships named except "DUNTROON" whose engines operated on the double acting principle - (a principle not now favoured).

In Appendix 5 some fuller details are given of WESTRALIA I" as typical of the point reached in passenger-cargo ship design in 1900. For comparison, Appendix 8 contains similar details relative to "KANIMBLA" which, with "MANOORA", a very similar ship, is here suggested as representative of the peak in this class of naval architecture.

Appendix 7 comprises numbers of ships in service in 1946 restricted to the fleets of Companies so far considered. Two additional groups of ships are also shown because of their size and importance, namely, the fleets of Broken Hill Proprietary Company, consisting of 8-No. iron ore bulk carriers, and of the Commonwealth Department of Supply and shipping consisting of 15-No. Australian wartime built ships.

Twelve (12-No.) of these latter ships were the

standard "A" class of dimensions 425 ft. x 56.6. ft. x 27.5 ft. and deadweight capacity of 9000 tons.

They were propelled by a triple expansion steam engine with an exhaust turbine developing 3500 I.H.P. to give a service speed of 12 knots. In all, thirteen (13) of these ships were built, the last, the "RIVER BURNETT" entered service in 1947. For post-war work they proved to be rather too big. The smaller "B" class, 6300 tons D.W., have proved better economically, but even they are now found to be rather large. These comments, however, belong to the post-war period Part VIII.

P A R T VII

AUSTRALIAN SHIP AND ENGINE BUILDING

(a) Shipbuilding.

From the earliest Colonial days the natural tendency was to build the wooden schooners, sloops and barques locally from locally grown timbers, which was sound and natural to men accustomed to the sea. Many such ships were built. When about 1850 timber as the hull material began to be replaced by iron, and again from about 1885 when iron in turn began to give way to steel, questions of local supply of such materials placed limitations on shipbuilding even more telling than lack of technical knowledge.

However, there were some notable feats of "Assembly", such as the A.U.S.N. Co.'s S.S. "BALLARAT", an iron steamer. Parts were shipped from England in 1853 and assembled at the Company's patent slipway then recently established at Pyrmont.

The first really organised production of ships occurred in 1911, when naval vessels, commencing with the destroyer "WARREGO", were assembled and, or, built at Cockatoo Island Dockyard. The programme included the two light cruisers "BRISBANE" and "ADELAIDE" and was a clear indication of what could be done.

In 1917 the Australian Government commenced a programme of mercantile shipbuilding to meet the pressing demands of the 1914-1918 war. Specifications and plans were purchased from Britain for a standard ship of 5000 tons deadweight to be constructed on the Isherwood system of longitudinal framing. Steel plates had to be imported from England and America, but frame sections were produced locally. Altogether nineteen ships were built at Sydney, Newcastle, Maryborough, Melbourne and Port Adelaide.

The first six were launched during 1919 and 1920 each of 5608 deadweight tons and 3350 gross tons with a speed of 9½ knots. They were the so called "D" class vessels. S.S. "DUMOSA" was such a one.

The remaining thirteen ships followed in 1920 to 1922. They were the "E" class, similar but with a slightly larger deadweight carrying capacity.

In 1923 and 1924 the two much larger refrigerated cargo ships "FERNDALE" and "FORDSDALE" - speed 14½ knots - appeared. These represented the peak of this effort. At £30 per ton such ships were far too expensive. Their triple expansion engines were built by Thompson & Co. of Castlemaine and the Government Dockyard at Walsh Island, Newcastle. They were equipped with Babcock and Wilcox watertube boilers - steam pressure - 190 p.s.i. Three (3) per ship.

In 1940 the Commonwealth Government again decided to construct merchant ships to meet the heavy demands of war. Accordingly the Australian Shipbuilding Board was constituted in 1941, and made responsible for the building and repair of all ships other than naval ships.

It was finally decided to construct the following types of ships:

13 - No. "A" class. approx. 9000 tons D.W.
8 - No. "B" class. approx. 6000 tons D.W.

10 - No. "D" class. approx. 2900 tons D.W.
5 - No. "E" class. approx. 550 tons D.W.
22 - No. Wooden Cargo Vessels of 300 tons burden.

This original construction programme was completed.

It has been followed by "Iron" class vessels for the B.H.P. Co. each of approximately 10,000 tons D.W., and another class of approximately 10,000 tons, all bulk carriers, for the Australian National Line. A larger type of bulk carrier, the "Mount" class, of 14,000 tons D.W., is now in hand for the Australian National Line.

Although the Australian Shipbuilding Board co-ordinates the shipbuilding industry in Australia, administers the 33 1/3% subsidy allowed by the Government on ships above 500 tons gross to enable Australian shipbuilders to compete in the world market, and provides professional design information, it is at the shipyards, all privately owned except two, where such plans are executed.

The history of these shipyards will form part of another paper in this session, and for statistical data reference is invited to Australian Shipping and Shipbuilding Statistics 1960 - an annual publication since 1958 of the Department of Shipping and Transport.

For completeness the shipyards will be named as under, with the approximate date when shipbuilding commenced:

Cockatoo Docks and Engineering Co. Ltd., Sydney, N.S.W.,	1858.
Walkers Limited, Maryborough, Queensland,	1882.
Poole & Steele Ltd., Sydney, N.S.W.,	1913.
H.M.A. Naval Dockyard, Williamstown, Victoria,	1938.
Broken Hill Proprietary Ltd., Whyalla, South Australia,	1940.
Evans Deakin & Co. Ltd., Brisbane, Queensland.	1940.
State Dockyard, Newcastle, N.S.W.,	1942.

It is unthinkable not to mention MORT'S DOCK AND ENGINEERING CO. LTD. whilst thinking of shipbuilders. This great shipyard commenced operations in 1853 and was voluntarily liquidated in 1959. It preceded Cockatoo Dockyard by five years as the oldest in Australia. Its demise was a great shock and a great loss to the whole shipping industry in Australia and overseas.

On a quantity output basis Australia is a very minor nation as can be gauged from the list of new ships classed by Lloyds Register of Shipping during the year ended 31st December 1960. This indicates that six (6) ships were built in Australia totalling 23912 tons gross. By comparison Great Britain produced 319 ships totalling 1,314,823 tons. The Netherlands were next highest with 80 ships totalling 369456 tons and Germany 53 ships totalling 364501 tons. Canada produced 9 ships totalling 67564 tons.

However, Australian shipbuilders do claim to produce ships of high quality, and very few, if any, dispute this claim. Quality of workmanship is excellent, and, in fact, is believed to be unnecessarily high in some respects. It is possible to overdo some non essential parts of a ship, perhaps at the expense of essential parts. It could be an indication of shipbuilding immaturity. In any event Australian costs are unfortunately higher than those of other countries, particularly of Great Britain, which has always been the main source of supply of Australian ships other than Australian shipyards. Realising this basic fact but desiring to promote, or at least sustain, a shipbuilding industry twice found

necessary in time of war and twice built up from practically nothing at great cost, the Government, in 1946, introduced a subsidy of 25% of the cost to build in Australia. In 1954 this was increased to 33 1/3% and in 1959 an enquiry was held to determine whether a further increase should be allowed. It was not, and the subsidy still stands at 33 1/3%, which, deducted from the Australian cost, is calculated to reduce an Australian tender to parity with world tenders, particularly those of Great Britain, with which, in all other respects it is required to compete.

The Report of this enquiry is entitled Tariff Board's Report on Shipbuilding Industry and dated 30th June 1959. It covers not only the shipbuilding industry, but also the shipping industry which should of course feed it with orders, and the whole document is a very interesting one, if also somewhat disturbing. Some extracts from it surely are excusable.

The principal reasons for subsidising the shipbuilding industry were given as (refer page 5) :

"(a) The cost of labour and materials (other than steel) is higher in Australia than in the major shipbuilding countries.

(b) The Australian industry is handicapped by its relatively small size, a handicap aggravated by the present lack of orders which is forcing most shipyards to work uneconomically and below their full capacity.

(c) Freight costs on imports afford little or no protection to Australian built vessels.

(d) A shipbuilding industry is essential for Australia's defence resources and commercial propensity.

(e) Small vessels such as tugs, lighters and dredges are a vital part of sea transport and their production contributes to full employment and the utilization of full capacity in the shipyards."

Less authoritatively the writer has heard the view expressed that the coastal shipowner enjoys protection from world competition under Clause 2[illegible] of the Navigation Act (already mentioned at length) and, if that is right, then so should the shipbuilder enjoy some protection. Hence the 33 1/3% subsidy.

The Report also revealed (page 9) that cost analyses for eight vessels showed total cost allocations :

Labour	24% to 30%
Steel	4% to 11%
Other materials	26% to 54%
Overhead	17% to 35%

The estimated cost of building these vessels in Great Britain was 73.3% (weighted average) of each cost factor. Such are the disabilities of the Australian industry which good workmanship does not offset. In fact, only good design and better deliveries can really secure an order for the Australian shipbuilder if, after deducting 33 1/3% from his price, he is then truly in the world arena. Here the very high standards required to meet the Regulations under the Australian Navigation Act should and do help the Australian shipbuilder because very few overseas shipbuilders normally are required to meet such standards.

(b) Engine Building.

On the machinery side, great steps have also been taken and no ship capable of launching at an Australian shipyard need import a main propulsion engine, although the choice is restricted to one or two designs.

The 1917-1922 shipbuilding programme of "D" and "E" class ships was supplemented by engine building by Messrs. Thompson & Co., Castlemaine, Victoria, and by the Government Dockyard at Walsh Island, Newcastle. These were standard triple expansion engines and Scotch type boilers. The programme which commenced in 1942 was, and is, similarly engined by Australian industry - at least as far as the main propelling engines are concerned.

The "A" or "River" class ships were provided with triple expansion engines of cylinder diameters 24½", 40½" and 67" and stroke 48" taking steam at 240 p.s.i. from McNeil type watertube boilers. A special feature of these boilers was the burning of coal on mechanical stokers, or alternatively oil fuel the apparatus for which was fitted at the other end of the furnace. The engine exhausted into a Bauer Wach exhaust turbine, at 10 p.s.i. absolute, increasing the power by about 25% to the propeller shaft through gearing and an hydraulic coupling, as usual in this arrangement.

These and similar units for the smaller "B" class ship were manufactured at the shipyards although such specialised items as the exhaust turbine were imported from Britain and the gears cut at specialised works.

A Commonwealth Government Marine Engine Works was set up at Port Melbourne to specialise in the construction of heavy marine engines realising that such was not only necessary to the wartime programme of standard ships with standard engines, but even more so to possible post war activities. Shipowners being traditionally private individuals have a natural reluctance to order standard ships. In many ways, a shipowner's personality is expressed in his ships and some alternative type of machinery had to be offered. This has been achieved in the form of Doxford oil engines, being built at Port Melbourne under licence from William Doxford and Sons Ltd., Sunderland, England.

The Commonwealth Marine Engine Works, Port Melbourne, is now engaged on the construction of its 37th and 38th engines. These are Doxford engines, type 67 LBD 5 each developing 5700 B.H.P. for installation in two bulk carriers each of 16400 tons deadweight carrying capacity being built at the B.H.P. shipyard, Whyalla, for Bulkships Ltd. (a new subsidiary of the five Companies mainly mentioned in this paper). The size of Doxford engine built at these Works has steadily increased since the first, engine No. 21,a Doxford type 56 lb. 4. developing 3000 B.H.P. was built in 1953 for M.V. "BOONAROO".

The previous twenty (20) engines were all steam engines, the first two being delivered in 1944 and 1945 for "RIVER LODDON" and "RIVER MITTA" then building at Williamstown Naval Dockyard. Their output was 3690 B.H.P. each. Four such engines, each of output 2790 B.H.P. were built for various "B" class ships, and three double compound Lentz engines each of output 1850 B.H.P. in 1946 for "D" class ships.

These Works also produce high speed steam eninges for driving auxiliary generators, and standard deck cargo winches.

An identical Works was built at Rocklea, near Brisbane, at the same time as the Port Melbourne Works, but this was closed after the war when the demand fell. It was taken over by The English Electric Company about 1950, and is now engaged on heavy electrical machinery manufacture.

Another important marine engine building activity is that of the well known Polar engine by the State Dockyard, Newcastle, under license from the parent Swedish Company, Messrs. Nyquist & Holm. This is a much smaller engine than the Doxford - in fact the M47M Polar engine as recently fitted into the latest Australian built tug "WALUMBA" develops 1310 B.H.P. at 300 R.P.M. It is a two (2) stroke engine, as is the Doxford, and very robust and reliable. Although world tendency in tug engines is towards the lighter, 750 R.P.M. and faster four (4) stroke engines, the Polar engine is very popular and there are many such engines in ships on the coast. However, State Dockyard is now building only its third engine. One reason for this is that ships built in Australia can only qualify for the subsidy of 33 1/3% if the gross tonnage is 500 or over. If so, of course, the engine, being part of the ship, also comes under the subsidy. However such craft as tugs do not qualify for this subsidy, and therefore an Australian built engine can only be bought for it at its full Australian price. As there is no tariff protection for engines of this size it is obviously much cheaper to import such an engine from Britain, unless it is for a ship to which the General Shipbuilding Subsidy applies, ie. if it is 500 tons gross or over.

Messrs. Walkers Limited, of Maryborough, can manufacture "Mirrlees" type engines under license. These also are in the smaller range.

There are indications that the Sulzer engine may shortly be built under license in Australia. This engine is comparable with the Doxford in size and range of powers.

Other possible developments include the overhauling of Deltic engines at the Commonwealth Marine Engine Works, Port Melbourne, in conjunction with the English Electric Company.

(c) Some British Shipbuilding Comparisons.

If the Australian shipbuilding industry has its problems, so also has that of Britain from whence we draw our traditions and our knowledge. Although the British output of ships in 1959 is impressive, as is also the order book at 30th November 1959 amounting to 4,298,000 tons gross, the pertinent fact is that a year previously, at 30th November 1958, the corresponding figure was 5,665,000 tons gross. Plainly, orders are diminishing and competition from Continental shipyards is increasing.

Some interesting figures of British costs were published in "FAIRPLAY", 14th January 1960.

These are quoted verbatum.

For a standard diesel oil engined ship of 11000/13000 tons deadweight, speed 15 knots, sterling prices apparently are:

DATE	PRICE	PRICE PER TON D.W.	
		Closed Shelter deck Ship	Open Shelter deck Ship
	£	£. S.	£. S.
30th June 1956.	1,015,000	78 - 0	92 - 5
31st December 1956	1,045,000	80 - 10	95 - 0
30th June 1957	1,080,000	83 - 0	98 - 5
31st December 1957	1,105,000	85 - 0	100 - 10
30th June 1958	1,110,000	85 - 10	101 - 0
31st December 1958	1,110,000	85 - 10	101 - 0
30th June 1959	1,080,000	83 - 0	98 - 5
31st December 1959	1,030,000	79 - 5	93 - 10

For a built to requirement motor-ship (what "Fairplay" calls a "ready motor-vessel" of the same size) the cost per deadweight ton varied in 1956 from £92-5-0 to £65-5-0 for a closed shelter decker and from £109 to £77-5-0 for an open shelter decker.

"Fairplay" also gives some figures for a slightly smaller, and therefore more comparable ship of dimensions 425 feet x 58 feet x 29 feet to second deck and 38 feet to uppermost continuous deck. Deadweight tonnage as an open deck ship 9500.

Speed 12 knots from a 3300 B.H.P. diesel oil engine.

The cost per D.W. ton for such a standard shelter deck ship varied from £28 per D.W. ton in 1945, to £46-5-0 in 1950, to £72-10-0 in 1955, to £78-10-0 in 1959.

The corresponding "ready motor-vessel" varied from £25-5-0 per D.W. ton in 1945 to £67 per D.W. ton in 1959.

These are the order of sterling figures with which Australian figures must compare after application of the 33 1/3% subsidy.

Actually, a particular motor cargo-ship known to the writer built in 1955 to a high Australian specification of dimension 320 ft. B.P. x 49'-6" B.P. x 29'-8" to shelter deck speed 12 knots; cost £100 per ton D.W. This appears more realistic.

PART VIII

1945 - 1960 PERIOD

The last fifteen years of this Survey, from 1945 to 1960, have been in many ways as critical as the first such span from 1860 to 1875 when great movement was astir to expand shipping services to coastal settlements and to form groups later to become important Companies to finance and control such interprise. From 1945 to 1960 a critical observer might detect almost the reverse trend. Companies are still as sound as ever but their fleets have greatly diminished. Again the temptation is great to emphasise the competition from railways and road from the one viewpoint, whilst another view tends to criticise shipowners for lack of foresight particularly in not replacing the passenger ships, now almost extinct, immediately after the war. Yet another point of view emphasises the vast, almost terrifying labour unrest which permeates this industry. The backgrounds to these viewpoints are not the concern of this paper except insofar as they affect the design of ships which now emerge from their century of shipping on the Australian Coast.

However, it does appear relevant to the narrative to explain the way in which the Government built, and hence Government owned, ships of 1942 and onwards, have been integrated into the Coastal shipping scene to compete on equal terms with ships of the private Companies. Such, of course, represent further competition to the latter, but surely a stimulating and therefore most valuable one to Australia.

Appendix 7 shows that in the first post war year 1946 the fleets of the six main Australian Shipping Companies so far considered (including tugs) for convenience and comparison totalled 85 ships. Of these, five (5) were the passenger ships "DUNTROON", "KANIMBLA", "MANOORA", "MANUNDA", "WESTRALIA", in various stages of being refitted by the Navy for a return to their peacetime occasions. In addition the Broken Hill Proprietary Co. possessed eight (8) ore carriers, and the Commonwealth Department of Supply and Shipping owned seventeen (17) ships of which fifteen (15) were built in Australia under the Australian Shipbuilding Board, and under which source more ships were in hand. As these Government ships were the only newcomers of any consequence to the Australian coast during World War II they, and their Australian built successors must form the main subject of this period.

Of the 14-No. such ships in service in 1946, 12-No. were standard "A" class steamers already mentioned in Section VII and better known perhaps as the River Class, of 9000 tons deadweight and 5100 tons gross. They were reputed to cost A£640,000 each or £71 per ton deadweight in 1943. This class has now disappeared from the coast, the last group having recently been sold to far Eastern buyers. They were successful in war and later in carrying grain cargoes to India and similar charter work in Eastern waters, which ended mainly with the settlement of the Suez crisis. But for coastal general cargo work they were rather too large, and, because of their between decks, unsuitable for bulk trades. Only one more followed this group "RIVER BURNET" in 1947, making a total of 13-No. "A" class ships.

The other two Australian built ships classified by Lloyds in 1946 were "DELAMERE" and "DORRIGO". These were the smaller "D" class single deckers with poop bridge and forecastle superstructure in the former ship built at Whyalla, and

extended poop and forecastle decks in the latter built at Newcastle. This gave gross tonnages of 2333 and 2700 respectively. The extended poop deck was to permit some passengers. Deadweight tonnages were 2800 and 2200 costing £390,000 and £500,000 each or £140 per D.W. ton for the three-island cargo type and £227 per D.W. ton for the cargo passenger type. Both ships were propelled by double compound Lentz steam engines, later to be replaced in one of this "D" class by Polar diesel engines as a trial conversion. It is believed that although the conversion was a technical success its cost was not economically justified. These ships were built to dimensions 270 ft. B.P. x 46 ft. x 21½ ft. for a speed of 12 knots and are a useful size for some of the less lucrative trades such as those to Darwin as a terminal port. The latest returns indicate that six of this class are still operative.

The immediate post war years saw an Australian shipbuilding emphasis on to the intermediate class, the "B" class, at least one of which was acquired by each of the major shipping companies. For example, Adelaide Steamship Co. purchased S.S. "BORDA" and S.S. "BAROOTA", Australian Steamships took over S.S. "BALAAR", Huddart Parker S.S. "WOOMERA", McIlwraith McEacharn S.S. "KOORAWATHA", A.U.S.N.Co. S.S. "CALOUNDRA" and the Australian Shipping Board (now the National Line) acquired S.S. "BILKURRA", S.S. "BINBURRA", and M.V. "BOONAROO". All these ships are actively employed. They are built to dimensions 380 ft. B.P. x 53 ft. x 24¼ft. to upper deck (33 ft. to shelter deck). Their tonnages are 6300 deadweight 4100 gross. If anything they too are proving to be rather too large for coastal service.

The construction of the "B" class of ships was completed in 1954 after which the emphasis has been placed on special ships - mainly bulk carriers, drive on-drive off vessels, container ships such as, by name, "LAKE COLAC" 10221 tons D.W., "IRON FLINDERS" 19000 tons D.W. (B.H.P.Co.), "MUNDOORA" 5200 tons D.W. (Adelaide S.S. Co.). MV."PRINCESS of TASMANIA" is the first drive on - drive off ship now being followed by "BASS TRADER".

The fact that the last named really revolutionary ships have been built for, and will be operated by, the Australian National Line which was formerly the Australian Shipping Board, prompt some diversionary notes on this now permanent pattern of Government owned ships operating in competition with those of the private Shipping Companies.

After the war it was thought by many that the Shipping Companies would be permitted to purchase the wartime built ships as did occur after the first world war. Negotiations were spread over many years but finally broke down and the Australian Coastal Shipping Commission Act was passed in 1956. This Act (No. 41 of 1956) repeals the Shipping Act of 1949 and authorised the winding up of the Australian Shipping Board, and is described as "An Act to establish an Australian Coastal Shipping Commission to operate certain Shipping Services, and for other purposes". The Commission consists of five Commissioners appointed by the Governor-General (Section 8), and one of a list of thirteen Powers of the Commission set out in Section 16 (2) is "to carry on the general business of a shipowner in relation to any shipping service operated by the Commission". An important Section 17 empowers the Minister to order the Commission to operate a shipping service "to meet the requirements of a particular area when it is desirable in the public interest that such a shipping service should be provided". This, of course, is beyond what can be expected

of a private Shipping Company which of necessity must, without too much delay, show a financial return to its shareholders. A provision of the Section entitles the Commission to be re-imbursed by the Commonwealth Government in the event of a loss (under certain conditions). A Shipping Company would not be entitled to such re-imbursement.

Obviously, an important part of this Act is the protection of the Shipping Companies which could otherwise be completely superseded by the Commission. Hence we find another Act (No. 42 of 1956) entitled the Australian Coastal Shipping Agreement Act and described as

"An Act to approve an Agreement entered into by the Commonwealth with respect to Australian Coastal Shipping, and for purposes connected with that Agreement".

This most important document, after naming fifteen Companies with whom an Agreement was made with the Commonwealth of Australia on 18th May 1956 continues thus:

> "WHEREAS the Commonwealth Government proposes to introduce legislation into the Parliament of the Commonwealth to constitute a Commission to be called the Australian Coastal Shipping Commission.
>
> AND WHEREAS the Companies and the Commission, when it is constituted, will be major operators of Shipping services on the Australian coast for the transport of passengers and goods:
>
> AND WHEREAS to facilitate trade and commerce among the States and assist the defence of the Commonwealth it is expedient in the opinion of the Commonwealth to make provision for the purpose of ensuring
>
> (a) the continued operation by the Companies as well as the Commission of ships in the Australian trade;
>
> (b) the maintenance of competition between the respective Companies and between the Companies and the Commission;
>
> (c) the efficient and economical operation of shipping services in the Australian coastal trade; and
>
> (d) the maintenance of the Australian ship-building industry."

The document proceeds to discuss details of the Agreement one of which (Clause 5(1)(a)) requires the Companies to "acquire and maintain in operation vessels of sufficient number and tonnage and of such types as will, with the vessels of other Companies and of the Commission, provide adequate, efficient and economical coastal and territorial shipping services". Companies are also charged (Clause 5(1)(6)) to "conduct their shipping operations in an efficient and economical manner and under competitive conditions."

These two documents heralded the AUSTRALIAN NATIONAL LINE and have been quoted in some length because they are the current instruments under which Government and private enterprise are competing in the Australian coastal trade, and also, it will have been noted, by which the Australian Shipbuilding

industry is hoped to survive.

Returning to the historical narrative it will not be surprising to note that few ships of consequence have been built overseas for the Australian coast since 1956, although James Paterson's "PATTAWILYA" and Huddart Parker's "WATAMURRA" were purchased overseas as secondhand ships to meet particular urgent conditions in 1957 and 1956 respectively. McIlwraith McEacharn's orders for "KOOYONG" and "KOOLIGA" (new buildings) were also placed in Scotland about this time.

Prior to 1956, however, a number of cargo ships were built in Britain during this post war period for the coastal trade, several even for the then Australian Shipping Board, forerunner to the National Line for which the ships ("TIMBARRA", "NILPENA") now operate. This was permitted because of full employment in Australian Shipyards at the time, and also because the Government subsidy, if any, was then 25% under which Australian tenders could not compete.

The Adelaide Steamship Company's "MINKARA" in 1954 was the first of a group of highly efficient cargo motor ships built in Britain in this period. She is not a large ship being of dimensions 311.4 ft. x 47.6 ft. x 19 ft., and gross tonnage 2616. As such she is indicative of a trend towards smaller units with quick cargo handling equipment. The emphasis in such vessels is reduction of time in port.

A similar theme prompted the design of Huddart Parker's "WARRINGA" (339.8 ft. x 49.8 ft. x 20.2 ft. Tonnages 2716 gross 1266 net) which appeared in 1955. She was built on the Firth of Forth as was "MINKARA", and is propelled by a Doxford four cylinder oil engine, and with a double set of electric cargo handling winches and derricks at each of her four hatches. She is a shelter deck ship, with provision for carrying refrigerated cargo loaded if required through "gun port" doors into No. 2 between deck where three such cargo chambers are located. Her deadweight lifting capacity is 4250 tons and speed 12 knots, although in the general cargo trade between Melbourne and Adelaide 10 knots is sufficient provided it can be maintained in all weathers. This is the important feature about speed - to maintain it - and the oil engine appears to suffer a little in comparison with the steam engine in ability to hold its revolutions. "WARRINGA'S" consumes 6 tons of marine diesel fuel per day and is regarded as a very efficient unit. She is now handling cargo in 3 ton containers which is the trend in the general cargo trade and the ships with the most adequate lifting equipment are the most suitable. "WARRINGA" represents an important step forward in ship accommodation planning coming probably as the first Australian ship whose keel was laid after the issue of the Australian Navigation Act Accommodation Regulations dated 20th April 1954. Hence all crew are accommodated in single berth cabins which are placed amidships under those of the officers. In this respect she resembles the American layout. In later ships, however, some of the crew are accommodated aft under the poop deck and there appear to be advantages in so placing seamen with recreation spaces whereas engine room personnel with mess rooms are amidships. Such an arrangement will be found in the same Company's "WATAMURRA", ex "FRED OLSSON", and acquired from previous Swedish Owners in 1956. She is somewhat smaller than "WARRINGA" being of dimensions 298 ft.b.p. x 44.3 ft. x 26.7 ft. and tonnages 1894 gross and 853 net. The low tonnages for such dimensions are an application of eonomic interpretation of the Tonnage Regulations in arranging for a many spaces as possible to be either deducted or exempted. These Tonnage Regulations have, of course, prompted the shelter deck ship especially on the Australian coast where until

recently the lighter classes of general cargo have predominated. However, with the heavier cargoes and especially deck cargoes, many feel that full scantlings should be carried up to the shelter deck.

A further feature of "WARRINGA", and also "WATAMURRA", is the location of the Officers' dining saloon at the after end of the boat deck directly over the galley, two and one deck below respectively, to which a food lift is arranged. This has undoubtedly proved a superior location to the earlier position amongst the officers' accommodation, and most later cargo ships of this type followed such an arrangement.

Continuing this line of small cargo motorships M.V. "BURWAN" and M.V."CENTURY" were built in Britain in 1956, and M.V."MACEDON" in Germany in 1957, for Australian Steamships (Howard Smith) Ltd., and "KOOLIGA" and "KOOYONG" as already stated in Britain for McIlwraith McEacharn reaching Australia in 1958. M.V. "YERINGA" also reached Australia in 1958 from Britain where she was built for Adelaide Steamship Company as a sugar bulk carrier. She has replaced at least two of the "BAROSSA" class in this service on the Queensland coast.

Two still smaller ships which were built in Britain for Adelaide Steamship Co. and Huddart Parker Limited in 1954 and 1955 were "MARRA" and "TATANA" each of dimensions 234 ft. x 39.5 ft. x 14.8 ft. of gross tonnage 1396.

They are both single deck ships with extended poop deck above and under which all accommodation is arranged. Propelled by British Polar engines they have been very successful and further indicate the trend back to smaller ships for general cargo.

This covers the group of overseas new buildings between 1954 and 1958. It is an important group because it comprises the last the Australian Coast will probably see of the general cargo carrier. Except for two small such vessels in 1959 for the Union Steamship Co. of N.Z., "POOLTA" and "RISDON", all other subsequent new ships have either bulk carriers or the drive-on drive-off ship "PRINCESS OF TASMANIA", and this would appear to be the pattern for the future.

Meanwhile the luxury passenger ships of the 1930's have been reduced to two, namely "MANOORA" and "KANIMBLA" with the sale of "WESTRALIA" and "DUNTROON" to overseas buyers. Aged 30 years and 24 years respectively both ships could in any case have been regarded as having endured faithfully and well a normal life span. The disturbing feature is that so far they have not been replaced. The whole economics of the specialised coastal passenger service appears not now capable of supporting such ships under Australian conditions.

As quoted ship totals have included tugs when owned by the five Companies whose fleets we have considered, it is relevant to add that a move is now afoot to replace many old steam tugs. The latest addition to the Melbourne tug fleet is the motor tug "WALUMBA" which replaced "EAGLE" in June 1960.

This period, and indeed the whole century, can well be ended by a perusal of what is now an annual publication of the Department of Shipping and Transport entitled "Australian Shipping and Shipbuilding Statistics" (reference 11). From this document can be seen, amongst a wealth of information, that TOTAL AUSTRALIAN OWNED - AUSTRALIAN REGISTERED SHIPS, 116-No. TOTALLING TONS D.W., 612377. TONS GROSS., 455094. In addition a further 10-No. New Zealand owned ships are licensed to trade on the Australian coast. Hence the TOTAL INTERSTATE FLEET IS 126 VESSELS AGGREGATING 640,202 Tons D.W.

PART IX - SOME TECHNICAL MATTERS

(a) SHIP

(i) Size.
(ii) Speed.
(iii) Cargo Carriage.
(iv) Cargo Handling.
(v) Accommodation.
(vi) Location of Machinery.
(vii) Number of Decks.
(viii) Life Saving, Fire Protection and Collision Prevention.
(ix) Maintenance - Records.
(x) Hull Corrosion Prevention.

(b) ENGINES.

(i) The Screw.
(ii) Compounding.
(iii) Triple Expansion.
(iv) Fuel Consumption.

Repeated reference has been made to Mr. Murray's paper already mentioned in these Notes as, in covering the story of "Merchant Ships 1860-1960", the Australian scene as well as the British and World Scene has been traversed as far as ship design, construction and propulsion is concerned. However, some points hereunder would appear to apply especially to Australian ships.

(a) SHIP.

(i) SIZE.

In merchant ships designed to trade world wide the general trend has been, and still is, towards larger ships. For example, in Britain, the average size of cargo ship built during 1870 was 240 feet long, whilst in 1900 it had risen to 320 feet long. In 1958 comparable ships averaged 465 feet long. Amongst the reasons for this trend are the facts that larger ships show a higher deadweight to displacement ratio, lower crew to deadweight ratio and lower speed to length ratio which means less resistance and power, and, altogether, better economy than a smaller ship. On the Australian Coast, however, this trend, although recognisable, has not been so marked in general cargo ships (it is more marked now in bulk carriers) - in fact the tendency in the past decade has been a reversion to the smaller general cargo ships with an abundance of cargo handling equipment. This is obviously the result of a reduction in the volume of general cargo and the desire to deliver it quickly on fixed time table schedules. In 1960 the most popular general cargo carrier is a vessel about 300 feet long with a deadweight cargo capacity of about 3500 to 4000 tons, and speed of 12 knots in all reasonable weather.

(ii) SPEED.

Until recently speed was not such a vital requirement. Ten (10) knots was usually sufficient for voyages of up to say 600 miles as between Melbourne and Sydney, providing it could be maintained in adverse weather. However, these short haulages are now mainly lost to road transport with its unique feature of door to door delivery, and the

same ships on longer runs from say Melbourne to Fremantle are found to be too slow. Fourteen (14) knots, and in all reasonably bad weathers, is the desirable speed of 1960. This factor must cause an increase in ship size to accommodate the greater power plant. The well known relationship speed in knots divided by the square root of the length in feet should equal about C.6 for economical propulsion. from the sudden upward trend in the last decade of this figure noted by Mr. Murray

(iii) CARGO CARRIAGE.

Another reason for larger size ships is the trend to carry general cargo in containers. These steel lock-up boxes are designed mainly for a gross deadweight of 3 tons. The tare weight of the containers themselves has not yet been reduced to less than one-half ton, which means that considerably more volume is required to carry general cargo by this means than by stowing each item individually in the hold as formerly. However the advantages are obvious. The indications are that a ship to lift 3750 net tons of cargo in containers will require to be about 380 feet long, and 7000 shaft horse power will be required to yield 14 knots service speed.

(iv) CARGO HANDLING.

Only now, in 1960, is the tendency clear and definite that the century old methods of handling cargo by means of derricks, wire runners and winches, all carried by the ship, are to be replaced by cranes. Unlike Europe, Australian ports are to date generally not so well equipped with dock side cranes, and, in this period under review, the ship's equipment has usually been the sole means of loading and discharging. In Britain ship's cargo handling equipment is administered not under the Merchant Shipping Act directly but under the Factories Act. In other words, when a ship is no longer at sea and is working cargo at a dock side the same safety provisions apply as in a factory. This is not so in Australian Ports. Ships cargo handling equipment is provided for in the Navigation Act, and the operative regulations under the Act are the Loading and Unloading Regulations. The equipment is surveyed annually by Surveyors as part of the Equipment Survey, and derricks proof tested each four years usually, for convenience, concurrently with the Lloyds Special Survey. These Regulations are about to re-appear in revised form when it is expected that considerable limitation will be placed on the working in Union rig. To the present, cargo derricks have invariably been designed and proof tested (usually for a S.W.L. of 5 tons) for operation as Swinging derricks. For many years, however, Union Rig has been the favoured method of working in Australian ports. Luckily, perhaps, the load has been limited to the S.W.L. of the most convenient sized wire runner which is $2\frac{1}{2}$" circumference with a S.W.L. of 3 tons. Union Rig operation can impose greater loads on the guys, with components of load along the derrick itself, and the new Regulations are expected to reduce the S.W.L. in Union Rig to one-half ($\frac{1}{2}$) that of Swinging Derrick operation unless a higher S.W.L. can be proved to be safe. With the advent of 3 ton gross containers, and 5 ton parcels of steel, some major alterations will probably be necessary to some ships' equipment, and the ultimate effect in new tonnage will probably be a change to cranes. Bulk carriers can now generally rely on loading and discharging equipment at their terminal ports.

HATCH COVERS of the folding or sliding type have now super-
(v) ACCOMMODATION. seded the traditional wood planks on portable hatch beams.

With the appearance of the Navigation (Accommodation) Regulations in April 1954 the trend, which commenced much earlier, towards a very high standard of accommodation was

legalised. Generally, the Australian Regulations follow the British Regulations resulting from the 1948 International Convention for the Safety of Life at Sea. Probably the greatest difference is the provision of single berth cabins in all ships of 2500 gross tons and over. In practice this has come to mean single berth cabins in all ships unless quite impossible for space reasons. Another Australian provision contained in these Regulations is an Accommodation Committee comprising four representatives of Shipowners and four representatives of the Maritime Trade Unions under the Chairmanship of the Director of Navigation who has the casting vote. All accommodation plans for new ships have to be examined and passed by this Committee on which pressure is even exerted to carry accommodation standards far beyond the minimum laid down in the Regulations.

As well as mechanical Air Ventilation Australian ships are required to have natural ventilation of cabins. Now the trend is towards full air conditioning in new ships. Hot and cold running water in all cabins is another accepted extension of the Regulations, and strong agitation invariably follows any lowering of standards in the furnishing of crew's cabins compared with those of officers. An Arbitration Award provision provides for the re-painting of all accommodation at intervals not exceeding 15 months. This has prompted the use of laminated plastic materials for bulkheads, and where possible, for deckheads also, as this material does not require re-painting. In a new ship its high cost is therefore justified. Laminated plastic lined plywood is also used for table tops and suitable furniture.

Generally, the basic consideration is to save subsequent maintenance even at phenomenally high initial cost. Thus we see duralium framed chairs in mess and recreation rooms, duralium or stainless steel furniture especially in galleys where the use of wood, so long unchallenged, is now fast disappearing. Accommodation floor coverings have been a troublesome problem because of the tendency to use detergents as a labour saving cleaning device. Linoleum and rubber, in either sheet or tile form, have given way to an asbestos based tile which so far appears the most satisfactory to date.

The location of crew accommodation has already been mentioned elsewhere. The forecastle, of course, is not now allowed, nor is any space below the main deck. The earlier tendency to group all accommodation amidships is now rather relaxed in favour of the poop superstructure for some seamen.

Accommodation is also surveyed annually under the Navigation Act before a new Equipment Certificate is issued.

(vi) LOCATION OF MACHINERY.

Tradition and custom die hard in maritime thinking, and the moving of the machinery from amidships to aft has been long and spasmodic. The advantages of placing it aft at last appear established in Australian service as elsewhere. Mr. Murray devotes considerable space to these advantages pointing out that initially the midship position was favoured because it provided better space for the cumbersome horizontal steam engines of the paddle ship days of over a century ago, and later, for coal burning ships in which the fuel had to be carried adjacent to the machinery space and it was necessary to avoid extreme alterations in trim as the coal was used. The change to oil fuel, of which less was required, provided more flexibility in relative machinery and fuel tank location, and has enabled the full and valuable amidship section to be used for cargo. Machinery aft does, however, create more ballast problems, and a deep tank, or balancing tank, forward,

as well as the fore peak tank, is often an unwelcome requirement. To avoid this extra ballast tank a compromise is sometimes effected as in the "BAROSSA" class, of arranging three holds forward of the machinery space and one hold aft.

Mr. Murray gives an interesting comparison of hogging bending moments of the same ship

(a) with engine room and deep tank amidships.
(b) engine room three quarter way aft and deep tank a little forward of amidships.
(c) engine room aft with deep tank forward.

The bending moment figures indicate the advantages of the engines aft condition (c). It is particularly notable that although the ship is assumed to be homogeneously loaded in ballast condition, with deep tank empty, the bending moment is still a hogging one.

The figures do in fact support the assumption that a merchant ship, especially with engines amidships, is more often subject to hogging stresses than to sagging stresses. This fact has prompted the trend to longitudinal framed construction at least as far vertical as the tank tops and transverse framing from thence. Longitudinal framing under single decks is also very sound practice. The lack of longitudinal strength along the bottom revealed itself in some of the fully welded [illegible] structures of the immediate post-war years when transverse framing was adopted as in riveted ships but without angle brackets necessary in riveted floor construction but unnecessary in welded construction. Buckling of shell plating was soon noticed especially as the deck plates began to wear and perhaps more and more elastically. Modifications in DB spaces are often effected by welding horizontal intercostal between frames.

(vii) NUMBER OF DECKS.

The shelterdeck type of ship has always been popular on the Australian coast for general cargo carriage because of the large volume [illegible] capacity thereby provided. With the present trend to bulk cargoes, however, single deck vessels are preferred. For Containers it seems clear that an "open ship" will emerge i.e. a class having a very wide hatch, almost out to the ship's side, so that containers can be handled straight in and out by gantry crane.

Cargo ship accommodation has already been referred to three superstructure decks, poop, bridge and forecastle, except that the 1948 Convention finally eliminated the forecastle for any such purpose.

In passenger ship layout, there is a notable difference between ships of the nineteenth century and those of the twentieth. The built up tiers of passenger decks so familiar today were notably absent in British and Australian passenger ships up to 1900. Quoting from Mr. Murray's paper "This derived from the Merchant Shipping Act which limited the number of passengers carried on the upper deck. In 1894 the Act did not permit passengers to be carried on more than two decks, with the exception that one cabin passenger for every 100 tons of ship's registered tonnage could be carried in a poop or deckhouse. This restriction, which had an indeterminate origin, was not removed until 1906, when the 1894 Act was amended to the effect that passengers could not be carried on more than one deck below the waterline; no mention is made of passengers above that deck. In other countries, notably in Germany where the restriction did not apply, a greater number of passengers were carried above the

upper deck and thus better accommodation could be offered" - "The amendment to the British Merchant Shipping Act allowed British designers more latitude, and advantage was taken of this in the "LUSITANIA" and "MAURETANIA" where three tiers of superstructures were fitted."

This latitude was quickly applied to the Australian passenger ships of the 1900-1920 period, and the main difference between say "WESTRALIA I" and "ULIMAROA", "CANBERRA", "KAROOLA" etc. is explained. But as mentioned when describing these ships the preference was to carry the long poop deck of their predecessors forward for the whole ship's length to provide not only forecastle crew accommodation but "steerage" passenger accommodation thereabouts as well. The long poop deck was then added for promenade purposes with a bridge deck above as the well known boat and sports deck. Navigating and Engineer Officers' accommodation is arranged in further superstructure on this deck. It is the popular conception of the orthodox passenger ship of 1960. It is most unfortunate that Australian economic conditions do not now permit what was in the 1930's a business man's very popular recreational weekend - to leave say Melbourne on Saturday afternoon and reach Sydney or Adelaide in time to be at his place of business by 9 a.m. on Monday.

Obviously the Naval Architect will suspect difficulties in these tiers of superstructure decks upon which the Regulations set no limit as to number. Continuing from Mr. Murray's paper -

"The addition of several tiers of superstructures to the top of the main hull girder of the ship brought with it certain problems of strength and stability. From a theoretical point of view it is obvious that it is better if advantage can be taken of the contribution which an efficient superstructure may make to the main hull girder of the ship, but in practice it is difficult to achieve the integration."

In 1878 it was advocated that "it was infinitely better that the superstructure should be severed at different parts of its length to prevent it taking the longitudinal strain in an undue degree than to carry it right fore and aft".

This argument has its supporters today and hence the expansion joints often to be found in boat and promenade decks.

The other argument of course is that of 1915 which "advocated that the scantlings of superstructures should be so proportioned that they should be able to take their share in the general straining action of the hull --".

This latter approach, of course, lead to heavy superstructures and serious effects on stability. The 1960 solution is the use of aluminium, of which Mr. Murray says -

"An important method of obtaining the best of all worlds, however, is by making the superstructures of aluminium alloy. The Tom Young's Modulus of this alloy reduces the stresses on the superstructure and makes it possible thus to accept greater strains and displacements than would be possible with steel.

Aluminium superstructures are about half the weight of the steel structures they replace, taking into account the fire insulation requirements and the lightening of the weight obviously eases the stability problem. Broadly, it can be said that for a given beam three tiers of aluminium superstructures can replace two tiers of steel structures without

detriment to the stability."

Unfortunately, structural drawings of the Australian passenger ships of the 1900-1920 period are not available. One would not be surprised to find their superstructures designed for full strength and thus were relatively heavy. Such would perhaps help to explain the doubtful stability for which they are remembered.

(viii). LIFE-SAVING, FIRE PROTECTION and COLLISION PREVENTION.

The Australian Navigation Act Regulations follow closely those of the British Merchant Shipping Act, and reflect a very close interpretation of the several International Conventions for the Safety of Life at Sea at which Australia has been represented. It can rightly be claimed that Australian standards are very high and accidents and loss of life as a result are remarkably low, at least since the application of the Navigation Act. Before then, the record of ship losses is not so good, and an alarming number of wrecks lie in the vicinity of such turning points as Wilson's Promontory and Gabo Island.

The latest International Conference was held in London in June 1960 under the auspices of I.M.C.O. (Inter-Governmental Maritime Consultative Organisation). Previously these Conferences have been convened by the British Government, the first occurring in 1913 following the "TITANIC" disaster. The journal "FAIRPLAY" published some interesting background on 12th May 1960, and because it is sometimes wrongly thought that British interest in safety of life at sea commenced with this gigantic tragedy some relevant extracts from the "FAIRPLAY" article are transcribed in APPENDIX 10.

(ix) MAINTENANCE - RECORDS.

By comparison with corresponding British Companies, the Australian Shipping Companies are small. For this reason the Marine and Engineer Superintendents, or even more so the Superintendent if he is responsible for the whole ship, cover such a wide field that they cannot afford the time to become as specialised as most wish to be. They read and hear with envy of such ideal systems as Planned Maintenance adopted by the Navy and large British Companies. Such systems naturally require trained staff to operate them and can rarely be justified in a small company. In practice most Australian Ship Superintendents find keeping ahead, or even up with, the survey requirements of the Navigation Act and Lloyds Rules as much as can be done efficiently with resources available. And in fact these Survey requirements being designed to maintain the strength and seaworthiness of the vessels are thus an excellent basis for maintenance.

In most Companies the policy is now to keep their ships operative and not to withdraw them from service for survey work, for any longer period than that required for their annual dry docking. Of course, this is not always practicable, and many believe that it is only deferring the day when the ships will perforce have to stop for a more thorough overhaul as in earlier times when conditions of trade were better. However, the policy is to defer such lay up periods for as long as possible. High labour costs also dictate this policy.

Both Survey Authorities are very helpful in permitting survey work to be executed on a "continuous" basis.

An inherent difficulty in ship survey work if and when a ship does lay up to complete what cannot be done whilst running (as usually occurs for Lloyds four yearly survey) is to draw up a programme of precisely what work has to be performed. Obviously this cannot be done until the part of the ship is opened up for examination, and often this is of such a magnitude that any defect found is best rectified then and there rather than close up and re-open it at a later date.

A vital part of the Superintendent's organisation is therefore his Records, not only of when surveys are due but the probable condition of each item in each ship. The writer would like to include reference to a system which formed the subject of some notes published in "THE BEACON" for March 1960 entitled "The Maintenance of Ships". Part III - "Records".

The first step is the establishment of a reasonable filing system common to all ships and the Superintendent's office where a drawer, or drawers, exist for each ship. As an experiment the files have been classified and numbered to agree with the U.D.C. ("Universal Decimal Classification") System (which is described in British Standard Specifications B.S.S. 1000A - 1957.)

The papers in each file are divided, as is the ship, into two main groups -

Fixtures and Outfit.

The fixtures are broken down into the U.D.C. heading and papers marked (Coloured) according to whether the matter concerns the Ship, Engine, or Catering Department.

Outfit is further divided into Equipment and Stores.

Each file is intended to contain the basic design data and details of subsequent work to improve or maintain each item of Fixtures or Equipment. Thus we should have the "life history" of such fixtures as Masts, Main Engines, Galley Stoves and such Equipment as Anchors, Engine Spares, Galley cooking utensils always readily available.

Stores are the expendible items such as paint, oil fuel and food, and details should be kept in the relevant file which is retained on board by either the Chief Officer, Chief Engineer or Chief Steward depending upon whether the department concerned is Deck, Engine or Catering, all under the Master.

A refinement is to maintain a card index system of life information concerning Fixtures and Equipment.

Also a visual chart showing each item and date surveyed, with another such chart showing when examined for reasons other than survey, is maintained and exhibited continually in the departmental office on board.

One finds that if such a simple system can be once established it is readily enough carried on, and in fact is the minimum to keep ahead both of Statutory requirements and the inevitable ravages of time and the sea.

A list of U.D.C. headings for either file or card index forms APPENDIX 11.

(x) CORROSION PREVENTION.

This problem is continually being studied in relation to ship maintenance, of course, but special mention is included because of a recent move to join in the work of the Royal Australian Navy, particularly in the field of underwater protective painting which is generally very unsatisfactory at present. Shipping Companies are represented by their Superintendents on the Marine and Underwater Paint Sub-Committee of the Naval Paint Committee. They co-operate in recording -

(1) the rate of deterioration in ship performance as the hull becomes fouled,
(2) the type and quantity of marine growth found at each dry-docking, and
(3) the performance of trial batches of paint.

Although just starting great hopes are held for the participation of Merchant Ships into this research, which has long been in operation in Naval ships.

(b) ENGINES.

(i) THE SCREW.

The most spectacular technical improvements between 1860 and 1960 are those to the efficiency of the marine propelling engines and associated equipment.

The use of the screw propeller for ships commenced with the "ARCHIMEDES" of 1838, and by 1845-1850 the paddle wheel was being replaced by it.

Most of the screw steamers, whether naval or mercantile, built in the years 1850-1860 had horizontal engines taking steam at 20 - 25 p.s.i. By 1862 the vertical type of steam engine, with cylinder above and crankshaft below, was well developed, and favoured by merchant ships which did not require to keep down the height of engines as did naval ships.

(ii) COMPOUNDING.

By 1860 the simple steam engines had given way in new construction to engines operating on the compound principle as introduced by John Elder in 1854. At this time also surface condensing was becoming increasingly favoured. Hence this period 1860-1960 really commenced with the appearance of the compound engine although it was a little later that such a modern innovation was seen on the Australian coast. The boilers at this time were of the box type, weak in design and the subject of some disastrous explosions. Steam pressures were limited to 25 p.s.i.

(iii) TRIPLE EXPANSION.

The success attending the compound engine led in 1871 to the development of the triple expansion engine, and the use of higher boiler pressures up to 60 p.s.i. The resultant necessity to improve boiler design produced the famous Scotch or cylindrical type. This type of plant was to be found in Australian ships of the 1880's and continued until the appearance of the diesel oil engine in the 1920's, and even then was fitted, with of course improved design, in ships designed as recently as 1945.

In Britain the triple expansion engine had a long and honourable career in passenger ships but in 1900 it had reached its zenith and began to be replaced by turbines.

In Australia, however, this did not occur as the ships were not large enough to warrent turbines which were, and to a lesser extent, still are very heavy fuel consumers in powers below about 15000 S.H.P.

(iv) FUEL CONSUMPTION.

The improvement in the efficiency of the marine engine is best expressed in terms of reduction in fuel consumption. Mr. Murray has taken the calorific value of coal as 13000 B.T.U./ton and that of oil as 19000 B.T.U./ton. "On this basis the heavy oil engine of 1960 is about seven (7) times as efficient as the compound steam reciprocating engine and boilers of 1860".

Comparisons of cargo ships indicate that specific fuel consumption has been reduced from about 4 lbs. of coal/S.H.P./hour to 0.4 lbs. of oil/B.H.P./hour in the diesel engine, i.e. from say 50,000 B.T.U. per S.H.P. per hour to 8000 B.T.U. per B.H.P. per hour.

Mr. Murray further comments that "Taken in conjunction with the improvements in resistance and propulsion, this means that the efficiency of the machine as a whole has improved say twelve-fold during the 100 years."

P A R T X

SUMMARY AND THE FUTURE

(a) SUMMARY.

1860 found only one recognisable Company in Australia operating a fleet of 20-No. iron Steamers ranging in size from 130 tons gross to 681 tons gross propelled by simple steam engines averaging about 100 N.H.P. Several Companies still well-known in 1960 emerged from private Shipowners in 1875 and developed during the hectic days preceding Federation until by 1900 these six (6) selected Companies owned a total fleet of 100 ships. This rose to 128 by 1920 when the Australian Navigation Act became effective. The number had fallen to 87 by 1946 and in 1960 it stands at 51 ships. However since 1946 the Commonwealth Government has entered the shipowning business and owns 43 ships which, with the Broken Hill Proprietary Company's 12 ships, brings the total to 106 ships.

Some further notes and significant changes and trends are -

(1) OWNERSHIP.

The change towards Government owned ships during the last decade after 90 years of exclusive, vigorous and generally efficient private ownership.

(2) SHIPBUILDING.

The second rise of the shipbuilding industry and its sustenance.

(3) TYPES OF SHIP.

The type of ship during the first two periods (of the five into which this review is divided) ending in 1900 was generally a combined passenger and cargo ship in the larger sizes anyway. From 1900 onwards passenger ships, which fall into two wave groups, carried cargo as well, but most coastal cargo was carried in a special class of ship which thus clearly emerged.

(4) TYPES OF CARGO.

The cargoes of 1900 which the specialised cargo ship had to handle were what is known as general cargo and coal. The succeeding 60 years has seen a change to bulk cargoes of iron ore, pig iron, sugar, limestone etc. as well as some coal. This change has caused a different type of ship to appear - the bulk carrier.

(5) Consequent upon (4) the size of bulk carriers has tended to increase, whilst that of the general cargo ship has tended to decrease, as typified by M.V. "MOUNT KEIRA" bulk carrier of 1960 with a D.W. of 14000 tons and M.V. "WARRINGA" general cargo ship of 1955 with the maximum of orthodox cargo handling equipment and a D.W.C. of 4250 tons.

(6) PASSENGER SHIPS.

The passenger-cargo ships, which began to emphasise the passengers' aspect from 1900 onwards have almost disappeared from the coast, at least in their orthodox form. A revival in the form of a drive-on drive-off vehicular passenger vessel - M.V. "PRINCESS OF TASMANIA"

appeared in 1959 and may set the future pattern for short run services. Otherwise it appears that overseas ships will more and more be permitted to carry passengers between coastal ports. A special clause, the subject of a Royal Commission at the time, was inserted in the Navigation Act to protect Australian shipowners from such competition appears therefore not to have succeeded as regards passengers - it has succeeded however in allowing a very high standard of both passenger-cargo and cargo ship to develop.

(7) SIZE, PROPORTIONS AND SPEED.

The design of ships on the Australian coast followed generally developments in Britain where most of the world's ships were built. Mr. Murray makes the following points -

(a) There was a general increase in size.

In 1870 a particular shipbuilder's average cargo ship was dimensions 223 ft. x 30.2 ft. x 17.6 ft. draught 16.7 ft. I.H.P. 435 for 7.5 knots.

In 1900 similar dimensions were 338 ft. x 46.8 ft. x 27.6 ft. draught 23.4 ft. I.H.P. 1500 for 9.25 knots.

In 1920 similar dimensions were 411 ft. x 55.2 ft. x 29 ft. draught 28.5 ft. I.H.P. 2750 for 10.75 knots.

In 1937 similar dimensions were 404 ft. x 57.9 ft. x 30.2 ft. draught 25.4 ft. I.H.P. 1725 for 10.25 knots.

The above figures are taken from the records of a particular shipbuilder Messrs. J. L. Thompson.

In 1958 British cargo ships averaged 465 feet long by 64.3 feet beam.

(b) With few exceptions ships were and are of the open or closed shelter deck type during this period.

(c) From 1860 to 1880 ships tended to be slender and narrow by modern standards. The ratio of length to beam was often as high as ten (10), and the ratio of depth to the weather deck to the beam was about 0.75.

(d) The cargo ship developed simply by adding deck superstructure to the flush-deck prototype inherited from sailing ship days. Eventually these deck superstructures became continuous awning decks for passengers, and later shelter-decks for cargo. In the latter case particularly further superstructure was added to accommodate officers and crew. In addition, this period saw the introduction of the double bottom which raised the height of the centre of gravity of the cargo.

(e) That the above should and did result in an unstable ship is understood from curves of the (B/D) ratio (i.e. Beam to Depth to weather deck) plotted against years.

We see that although individual ship types varied enormously after 1875 the figure was reasonably

constant at 1.3 from 1860 to 1875 irrespective of the type. This indicates that apparently decks and double bottoms were added without proportionate increase in beam. One is therefore not surprised to read of many ship losses in the North Atlantic grain trade in the 1870's.

(f) After 1880 distinct improvement is noted no doubt due to Lloyds, where Chief Ship Surveyor, Mr. Martell, had given, as one of the reasons for the losses, the "disproportionate dimensions of steamers". We note that by 1900 the (B/D) ratio for full scantling ships had risen to 1.9.

In modern open shelter deck ships this ratio is very close to 2.

(g) The beam also increased gradually in relation to length from $(\frac{L}{10})$ in 1860 to $(\frac{L}{10} + 12)$ in 1900.

Modern ships show an (L/B) ratio of about

(h) Block Coefficients appeared to rise from 0.72 in 1870 to a maximum of 0.8 in 1900 falling to 0.74 in 1937, as applied to Thompson built ships quoted in (a). No doubt the earlier five Block Coefficients were derived from sailing ship practice, and the later tendency to revert to it is due to a desire to improve ships speeds.

(i) The ratio V (speed in knots) to the square root of the length in feet varied little from an average of 0.5 from 1870 to 1937.

(j) Size of ship and speed are inter-related. If the economical speed is taken as that at which the cost of transport per ton per mile is a minimum it can conveniently be shown that this is about the speed at which the curve of ship resistance plotted against speed is critical, i.e. the power required rises disproportionately as this speed is exceeded.

(k) Continued comparison with British ships designed for world wide operations tend to become irrelevant to Australian coastal conditions. However, Dr. Corlett's summing up of the British tramp ship of 1955 is of interest:

> "The ships are structurally arranged as closed shelterdeckers, but operated normally as open shelterdeckers of approximately 10500 tons deadweight. The permanent closing of the tonnage openings enables approximately 2000 tons of extra deadweight to be carried. Speeds in general show an improvement over earlier tonnage and the statistical mean appears to be of the order of $14\frac{1}{2}$-15 knots trial speed".

That speed is a costly item is confirmed by Mr. MacTier, who, speaking in April 1960 with vast Blue Funnel Line experience to draw upon, said -

> "A 10,000 D.W. ton diesel tramp can steam at $12\frac{1}{2}$ knots on $11\frac{1}{4}$ tons of oil a day - - - 15 knots can only be achieved on $25\frac{1}{2}$ tons of fuel a day i.e. $2\frac{1}{2}$ knots costs over 100 per

> cent increase in fuel, and apart from the cost of fuel every ton of bunkers carried means a ton less deadweight cargo carried."

These references are mainly included to indicate the reasons why Australian cargo ships have never been provided with great speed - 12 knots on trial for a service speed of 10 knots has until 1960 been sufficient. Future indications, however, are that 14 or 15 knots will be required for container ship schedules.

(8) SHELTER DECK SHIPS.

It will be recognised that Australian ship proportions and speeds have followed much the same pattern as British ships on a smaller scale. The closed shelter deck cargo ship has not been adopted to date. If between decks are required it has usually been for space cargoes for which the reduced freeboard has not been necessary. However, difficulties are arising in the use of shelter deck ships for the carriage of heavy bulk cargoes, such as pig iron, as the centre of gravity of the cargo is low when the ship is loaded to her marks. This leads to a very high metacentric height and a "stiff" ship, liable to damage due to excessively violent rolling. Loading such cargoes into the between decks is expensive, and often the weather deck is insufficiently strong to carry as much as may be desired to reduce the metacentric height. In either such upper stowage the question of expensive securing of the cargo from movement in violent rolling has to be considered. An advantage of the closed shelter deck ship is that full scantlings are carried up to the weather deck thus permitting heavier deck cargoes than is permissible on the lighter open shelter deck.

(9) BULK SHIPS - CLEAR HOLD SPACE

Ships designed essentially for bulk cargoes are single deck vessels with special attention given to control of the metacentric height often by upper tanks, and also to drainage of water to the hold bilge suctions.

Another very important point, especially in bulk carriers, is the elimination of internal hold obstructions. In all ships, as stated by Mr. Murray

> "The elimination of the numerous closely spaced pillars was slow in coming for there was a strong body of technical opinion which held that the only way to keep the decks up and the bottom down was to provide a multiplicity of closely spaced pillars. These pillars were a source of great annoyance to shipowners, especially when timber cargoes were carried, and in the latter years of the nineteenth century a practice which had developed of circumventing this difficulty by the simple process of removing the pillars, caused some concern. It was the practice to wedge up the decks when the ship was full of cargo, but it is doubtful if all the pillars were replaced when the ship was empty. By 1905 Lloyds Register Rules gave requirements for widely spaced hold pillars in association with deck girders, but the clear hold ship of any size was here before the Second World War. During that time a type of standard ship was built in which the decks were supported by cantilevers. This design was not altogether successful since the strengthening

required for the frames carrying the cantilevers was under-estimated; a substantial cantilever requires a substantial frame to support it. The substitution of deep transverse and horizontal underdeck girders for widely spaced hold pillars was initiated in the bulk cargo carriers of the Great Lakes and in recent years this system of construction has been adopted in ocean-going bulk carriers also. When the liason between the bottom and deck afforded by pillars is removed, it is necessary to see that the ring structure is strong enough to resist the difference between the external and internal pressures. To meet the stresses which may be imposed in this way it has been found necessary to increase the depth of the double bottom in such ships, and experience now shows that if appropriate structural arrangements are made at the bilge as well, a clear hold design of ship will prove successful in service."

Because of the importance to Australian bulk carriers and also general cargo carriers using containers Mr. Murray's paper is quoted fully on this matter. The use of mechanical equipment such as end loaders and fork lift trucks in the holds of ships has emphasised this need to be clear of obstructions to an even greater extent than the older use of grabs which tend so often to cause damage to the pillars.

MAINTENANCE.

The high wage structure in Australia means very high costs of docking, repairs and such maintenance. Where pre-1950 it was common practice to lay up ships for two or three weeks per annum to permit Company Overhauls and painting, as well as Statutory Surveys, now every effort is made to keep the ships available and in service. Survey work is carried out progressively within the framework of the Navigation Department and Lloyds regulations which have in latter years permitted such practices. Company overhauling is also executed progressively or reduced considerably.

This need for operational availability to take precedence over maintenance delays call for a high degree of reliability in the machinery, and well trained officers and crew. For both a good records system is vital. Some comments on a system based on The Universal Decimal Classification are included elsewhere.

ENGINES.

The Australian Coast has seen ships propelled by all the recognised types of machinery - compound steam engines, triple expansion steam engines, steam turbines (not so much as powers have been rather too small for economical turbine plants) and oil engines. Each of these forms of prime movers either can be, and are being, manufactured in Australia.

Of the five periods, the most interesting from the engine viewpoint is the fourth namely 1920 to 1945. The oil engine appeared on the coast and was thoroughly tried in the passenger ships acquired in that period, also in several cargo ships. High maintenance costs rather retarded its popularity and the triple expansion steam engine was able to fight a"rearguard action" by looking to its efficiency. We find the appearance of poppet type valves on the high pressure end of the engine and an exhaust turbine on the low pressure end, and either Scotch or watertube boilers producing superheated steam instead of saturated steam of the

past. The 1939-45 War saw this type of plant still predominant on the Coast.

As it was necessary to build engines in Australia for wartime built ships, the type decided upon was the well tried triple expansion steam engine.

After the war, particularly in the past decade, all ships requiring about 2000 S.H.P. and under have been equipped with oil engines.

(b) THE FUTURE.

Professor G. M. Trevelyan ends his classic writing "History of England" with the following words -

> "Of the future the historian can see no more than others. He can only point like a showman to the things of the past with their manifold and mysterious message".

Such a "Showman" must certainly argue that there will always be ships on the Australian Coast, and, under the Navigation Act, those carrying local cargoes will be Australian ships. The cargoes are likely to be more and more predominantly the bulk type, with general cargo carried either in containers or aboard trailer trucks which can be driven direct on to the ship and sail with her.

Special ships will be required for this type of service for which the orthodox shelter deck type is now being used where possible, but which is unsuitable. Bulk carriers are already a specialised type to be seen in numbers on the coast, and two drive-on drive-off ships are building to follow the passenger drive-on drive-off ship "PRINCESS OF TASMANIA". Special Container Ships will probably have wide open hatches served by gantry cranes. Of special interest is the cargo drive-on drive-off ship "BASS TRADER" because of her machinery arrangement using two Deltic engines (Type T. 18-27K) each driving a controllable pitch propeller through a scoop controlled fluid coupling and an epicyclic double reduction gearbox. The engines have a maximum continuous rating of 2078 B.H.P. at 1600 R.P.M. reduced to a propeller speed of 175 R.P.M. The whole plan is to remove an engine, which weighs about 6 tons, and replace it by a spare engine, when routine overhauling is due. This is regarded as a great forward step in meeting the high labour costs in Australia. The proposed service between Melbourne and Tasmania lends itself to this plan, as a specialist workshop will be established at Port Melbourne to do the overhauling work. It is interesting to recall that Sir Harry Ricardo proposed this type of maintenance as long ago as 1933 when he suggested an almost indefinite number of small diesel electric units easily replaced and with a surplus available for shutting down if in trouble.

This type of machinery installation could well indicate the pattern for short ferry-type services. For the longer coastal services the direct coupled oil engine, of which at least one well-tried design is manufactured in Australia, appears to be the likely choice for many years yet.

That therefore is the story. It is gratifying to submit the suggestion that Australian Coastal Shipping has a bright future. After all, Australia is an island continent, discovered by seamen, governed initially by seamen, and permitted to develop under the long protective arm of the Royal Navy and its later local counterpart closely integrated with it,

as we hope it always will be. As with Britain, the sea is the key to the story of the past. If it is to be so in the future, it is our heritage to exert ourselves to make it so. The Institution of Naval Architects has always been in the forefront of the science and technique of ship design and construction, as a reading of Mr. Barnaby's Centenary publication quickly reveals. Long may it so continue.

It is appropriate to end by reference, with great humility, to Prince Philip's remarks when opening the Institution's Centenary meetings in London in May. His Royal Highness said that for 100 years the Institution had been considering the design and construction of ships, and over that period the world had witnessed a revolution in naval architecture which it was unlikely to see again. We were likely to see new materials and new methods of propulsion, but they were likely to be evolutionary rather than revolutionary. There is, however, now a greater place for the development of scientific ideas in the work of the Naval Architect. But there is no cause for complacency.

P A R T XI.

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Librarian,
Department of Shipping & Transport,
Melbourne.

"ONE HUNDRED YEARS OF MERCHANT SHIPS ON THE AUSTRALIAN COAST".

A P P E N D I C E S.

APPENDIX NO. 1.

AUSTRALIAN MERCANTILE FLEET IN 1860.

Total Number of Ships listed to the following Shipowners.) (22 Ships

SHIPOWNERS

A.U.S.N. Co. Ltd.	20 Ships.
Wm. HOWARD SMITH.	1 Ship.
Thos. J. PARKER.	1 Ship.
	22 Ships.

APPENDIX NO. 1A.

AUSTRALIAN MERCHANT FLEET IN 1860.

1. A.U.S.N. Co. Ltd. No. of Ships 20

(a) HUNTER RIVER STEAM NAVIGATION CO.

Name of Ship	Year Built	Tons Net	Tons Gross	
"TAMAR"			130	
"MAITLAND"			103	
"EAGLE"			224	

(b) AUSTRALIAN STEAM NAVIGATION CO.

"YARRA YARRA"			556	
"WARATAH"			256	
"CLARENCE"			222	
"CITY OF SYDNEY"			393	
"CITY OF MELBOURNE"			144	
"BEN BOLT"			500	
"TELEGRAPH"			367	
"BALLARAT"			-	
"BOOMERANG"			445	
"ILLALONG"			294	
"WONGA WONGA"	1854	682	1002	242.9'x27.5'x16.6'
"WILLIAMS"			218	
"GOVERNOR GENERAL"			502	
"LONDON"			405	
"GEELONG"			-	
"RANGATIRA			382	
"COLLAROY"	1853	264	419	180.9'x23.3'x11.1' Paddle Steamer 140 H.P.

APPENDIX NO. 1

2. WM. HOWARD SMITH

FLEET 1860. No. of Ships 1.

Name of Ship	Year Built	Tons Net	Tons Gross	Particulars
"YOU YANGS"	1856	457	672	Iron Screw barque 185.2'x27.9'x15' Raised quarter deck.

3. THOS. J. PARKER

FLEET 1860. No. of Ships 1.

"EXPRESS"	1853		177	Bay Steamer.

APPENDIX NO. 2.

AUSTRALIAN MERCANTILE FLEET IN 1875.

Total Number of Ships listed to the following Shipowners.	37 Ships.

SHIPOWNERS

ADELAIDE STEAMSHIP Co. Ltd.	5 Ships.
A.U.S.N. Co. Ltd.	15 Ships.
Wm. HOWARD SMITH & Sons.	8 Ships.
HUDDART PARKER & Co. Pty. Ltd.	7 Ships.
Thos. J. PARKER.	2 Ships.
	37 Ships.

APPENDIX NO. 3.

AUSTRALIAN MERCANTILE FLEET IN 1885.

Total Number of Ships listed to the following Shipowners.	67 Ships.

SHIPOWNERS

ADELAIDE STEAMSHIP Co. Ltd.	10 Ships.
A.U.S.N. Co. Ltd.	26 Ships.
Wm. HOWARD SMITH & Sons.	16 Ships.
HUDDART PARKER & Co. Pty. Ltd.	5 Ships.
McILWRAITH McEACHARN.	9 Ships.
MELBOURNE STEAMSHIP Co.	1 Ship.
	67 Ships.

APPENDIX NO. 4.

AUSTRALIAN MERCANTILE FLEET IN 1900.

Total Number of Ships (including Tugs) listed to the following Shipowners.	100 Ships.

SHIPOWNERS

ADELAIDE STEAMSHIP Co. Ltd.	27 Ships.
A.U.S.N. Co. Ltd.	21 Ships.
Wm. HOWARD SMITH & Sons. Pty. Ltd.	20 Ships.
HUDDART PARKER Limited.	18 Ships.
McILWRAITH McEACHARN.	9 Ships.
MELBOURNE STEAMSHIP Co. Ltd.	5 Ships.
	100 Ships.

APPENDIX NO. 5

TYPICAL PASSENGER CARGO SHIP OF 1900.

PARTICULARS OF S.S. "WESTRALIA".

Builders: Sir Jas. Laing & Sons, Sunderland

When built: 1897 Official Number: 106,415

Class: 100 A.1.

Dimensions: Length 327'4"
Breadth 41'2"
Depth 20'5"
Moulded Depth 23'

Tonnage: Gross 2922
Net 1777

Deadweight: 3040 tons on a draught of 20'11".(Displacement scale).

Displacement: 25 tons, to 1"

Hold capacity: 113,490 c.ft.

Bunker capacity: 23,668 c.ft.

Water Ballast: 555 tons in double bottom & peak tanks

Bulkheads: 6.

Winches: 8 cog winches

Size of hatches: 18' x 14', 20' x 16', 16' x 14', 12' x 10'.

Derricks: 9 (1 heavy)

Passengers: 118 Saloon, 57 Steerage

Engines: Triple expansion

When built: 1897

Builders: G. Clark Ltd., Sunderland

Cylinders: Three, 25", 41½", 68", Stroke 45"

Boilers: 2, double ended. Pressure: 180 lbs.

Surface: Grate 239'. Heating 7434'.

Furnaces: 12, corrugated

Horsepower: Nominal 412. Indicated 2608

Donkey boiler: 180 lbs. pressure. 2 Furnaces

Coal cons. per 24 hours: 58 tons.Unscreened & small Newcastel(N.S.W) coal.48 tons. Southern (N.S.W) screened and Wellington (N.Z) small coal.

Speed per hour: 13 knots

Co-efficient: .723 on 20'8½" mean draught

Refrigerator space: 9½ cubic tons

Steam Steering Gear: Steam windlass.

APPENDIX NO. 6.

AUSTRALIAN MERCANTILE FLEET IN 1920.

Total Number of Ships (including Tugs) listed to the following Shipowners. (128 Ships.

SHIPOWNERS

ADELAIDE STEAMSHIP Co. Ltd.	33 Ships.
A.U.S.N. Co. Ltd.	21 Ships.
HOWARD SMITH Ltd.	30 Ships.
HUDDART PARKER Ltd.	24 Ships.
McILWRAITH McEACHARN Pty. Ltd.	10 Ships.
MELBOURNE STEAMSHIP Co. Ltd.	10 Ships.
	128 Ships.

APPENDIX NO. 7.

AUSTRALIAN MERCANTILE FLEET IN 1946.

Total Number of Ships listed (including tugs) to the following six Shipowners. (85 Ships.

SHIPOWNERS

ADELAIDE STEAMSHIP Co. Ltd.	32 Ships.
A.U.S.N. Co. Ltd.	10 Ships.
AUSTRALIAN STEAMSHIPS Pty. Ltd. (HOWARD SMITH Ltd.)	16 Ships.
HUDDART PARKER Ltd.	11 Ships.
McILWRAITH McEACHARN Ltd.	10 Ships.
MELBOURNE STEAMSHIP Co. Ltd.	6 Ships.
	85 Ships.

COMMONWEALTH DEPARTMENT OF SUPPLY AND SHIPPING.	17 Ships.
BROKEN HILL PROPRIETARY Co. Ltd.	8 Ships.
	25 Ships.

TOTAL ABOVE 110 SHIPS.

APPENDIX NO. 8. APPENDIX NO. 9.

DETAILS OF A MODERN INTERSTATE PASSENGER SHIP - M.V. "KANIMBLA"

Built June 1936.

By HARLAND & WOLFF BELFAST.

Length O.A. 484'-3½" B.P. 460'-0"

Beam 66'-0" Depth 36'-0"

Gross Tonnage 11104.48

Nett " 6224.84

Load Draft 24'-2¾"

" Displacement 13554 tons

Light Draft 15'-6¼"

" Displacement 7936 tons

Tons per inch 56. 5. tons

Deadweight at load draft 5618 tons.

Size of Hatches.

No. 1	18'-0"	x	12'-0"
2	26'-0"	x	16'-0"
3	12'-6"	x	16'-0"
4	22'-6"	x	16'-0"
5	17'-6"	x	16'-0"

Hinged steel hatch covers (Except No.4)

Height of Coamings 2'-9"

" " Tween Deck 8'-0"

Length of Holds.

No.1 52'-0" No.2 60'-0" No.3 35'-0" No.4 63'-0"
No.5 60'-0"

Cargo Gear

No. 1	3	Steel	Derricks	7 ton S.W.L.
2	5	"	"	2 @ 5 ton, 2 @ 7 ton, 1 @ 25 ton, S.W.L.
3	2	"	"	3 ton S.W.L.
4	2	"	"	5 ton S.W.L.
5	2	"	"	5 ton S.W.L.

14 Clarke Chapman Electric Winches 5 ton S.W.L. @ 90 ft./Min.

Cargo Capacity.

Lower Holds	113839	cu. ft.
Tween Decks	192464	" "
Refrig. space	3537	" "
Total:	315860	

D.W. Capacity 1473.8 tons

Passengers	1st Class	231
	2nd "	125
Crew		169
	Total	525

Main Engine
2 Sets 8 cyl. Burmeister Wain single acting 4 stroke cycle airless injection.
740 m/m bore. 1500 m/m stroke built by HARLAND & WOLFF LTD. BELFAST.
B.H.P. Service 8500 @ 108. R.P.M. Turbo Blowers on Buchi Principle.

Thrust Mitchell type.

Propellers 16'-9" Dia. 3. bladed.

Boiler Clarkson Thimble tube

Alternative Gas/oil fired
Working pressure 100 lbs./sq. in.

Generators 4 - 6 cylinder

"Harlandic" 330 m/m bore 580 m/m stroke.

4 stroke airless injection.

Trunk type 430 b.h.p.

330 K.W. 225 volts.

Air compressors.

Two Harland & Wolff 4 cyl.
2 Stage 356 lbs./sq.in.

Refrigerating Plant

Two J. & E. Hall's C.C.2.

Fuel.

Main engines. Furnace oil.

Generators. Marine Diesel.

Capacity of Bunkers.

Furnace Oil	728 tons
Diesel Oil	222 "

Consumption. All purposes.

16 knots	35 tons
15 "	30 "
14 "	23 "

APPENDIX NO. 9

AUSTRALIAN MERCANTILE FLEET IN 1960.

OF 200 TONS GROSS & OVER.

Total Number of Ships (including Tugs) listed to the following six Shipowners.) (51 Ships.

SHIPOWNERS

ADELAIDE STEAMSHIP Co. Ltd.	16 Ships. 7 Tugs.
A.U.S.N. Co. Ltd.	4 Ships.
AUSTRALIAN STEAMSHIPS Pty. Ltd. (HOWARD SMITH Ltd.)	7 Ships. 1 Tug.
HUDDART PARKER LIMITED	6 Ships. 2 Tugs.
McILWRAITH McEACHARN Ltd.	8 Ships.
MELBOURNE STEAMSHIP Co. Ltd.	Nil
	51

MAIN ADDITIONAL SHIPS

AUSTRALIAN NATIONAL LINE (AUSTRALIAN COASTAL SHIPPING COMMISSION).	43 Ships.
BROKEN HILL PROPRIETARY Company Ltd.	12 Ships.
	55 Ships.

TOTAL ABOVE 106 SHIPS.

APPENDIX NO.10

BACKGROUND TO THE INTERNATIONAL SAFETY OF LIFE AT SEA CONFERENCE

LONDON 1960.

EXTRACTED FROM "FAIRPLAY", 12TH MAY, 1960.

References:

Works of a popular nature describing losses of "TITANIC", "MORRO CASTLE" and "ANDREA DORIA".

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(SECOND OFFICER "TITANIC" at time of loss)

(2) "Tramps and Ladies" page 271.
by Sir James Bissett.
(Eye Witness account of rescue of "TITANIC" Survivors).

(3) "Fire at Sea"
by T. M. Gallagher. (Muller, London 1959).
(Story of the "MORRO CASTLE")

(4) "Collision Course".
by Alvin Moscow. (Longmans, 1959).
(Story of "ANDREA DORIA" - "STOCKHOLM" Collision, 1956.)

It is probable that, even if the "TITANIC" had not been lost, the British Government would have sought to put safety of life at sea on an international footing at about that time. Because of the 1914-18 war, the convention was never brought into force internationally, but in this country the findings of the convention were applied under the Merchant Shipping (Convention) Act of 1914.

In 1929, another international conference was held in London, and the regulations adopted on that occasion were contained in the Merchant Shipping (Safety and Load Line Conventions) Act of 1932. Then, after the last war, in 1948, a third international conference on the safety of life at sea was held in London, when the provisions of the 1932 convention were confirmed and extended. These conventions dealt with both the design and the operation of passenger ships and, to a certain extent, cargo ships, and it is of some interest to trace briefly the course of developments in the various aspects covered.

SUB-DIVISION REGULATIONS

Ideally, a ship should be unsinkable and non-inflammable, and, although this criterion of perfection is manifestly unattainable, the regulations are designed to ensure that the ship approaches it as closely as is reasonably practical. The loss of the "TITANIC" laid emphasis on the necessity for seeing in the first place that the ship, if damaged through collision with another ship or in other ways, should be so sub-divided by bulkheads that she should remain afloat. In the second place, if the bulkheads do not fulfill their function, then the life-saving appliances should be efficient enough to save all on board.

It was perhaps natural that the sub-division requirements of the 1914 Act were rather too stringent, especially as far as they applied to "mixed" types of ships - that is, those carrying both passengers and cargo - and the 1932 convention permitted a more practical arrangement of bulkheads than the earlier one. For example, under the 1932 regulations, a mixed passenger and cargo ship 500 ft. long could have a draft 2 ft. greater than would have been permitted under the old regulations, with the same number of bulkheads but disposed in a slightly different manner. Similarly, a similar increase was allowed in a 750-ft. passenger ship. When the matter was again reviewed in 1948, other slight relaxations were made, though in specific classes of ships, like those engaged in cross-channel services, more stringent rules were applied.

When a ship is damaged by collision, she may be lost through lack of stability, as well as through lack of buoyancy, and in the 1948 convention, therefore, regulations were introduced to ensure that this should not happen.

STABILITY IN DAMAGED CONDITION.

In brief, passenger ships were required to be constructed so that, in the event of damage, the ship should remain stable and should not heel over more than 15 deg. Stability in the damaged condition could be maintained in several ways, including by cross, or compensating, flooding, and it is likely that this aspect of safety will attract considerable attention at the conference about to open.

The U.S. authorities have made no secret of their desire to see the convention requirements made more stringent in respect of sub-division and damage stability of passenger ships. With regard to damage stability in the damaged condition, they consider that this should be an inherent characteristic of the ship, obtained by means of permanent water or solid ballast and

not by flooding tanks in the event of damage. Their views are naturally based on the ANDREA DORIA-STOCKHOLM collision where the ANDREA DORIA was lost through lack of stability in the damaged condition; but there are other circumstances connected with that loss which make it an unsatisfactory basis for future legislation.

In the first place, it is not known if the ANDREA DORIA complied with the 1948 convention in all respects; furthermore, the sequence leading to the final loss is obscure. Most technical men, viewing the matter objectively, would say that the evidence does not point to the necessity for tightening up the requirements of the convention, and that the present regulations are reasonable, both from a practical and from a theoretical point of view.

THE FIRE HAZARD.

The danger of fire at sea is always present, and though the loss of life in British ships through fire has been small, there have been numerous outbreaks, especially in engine-rooms, which have led to damage, to delay and, regrettably, to death. The record in passenger ships has fortunately been good, and this may be ascribed to two factors; the care exercised by the personnel on board ship to see that fires do not start, and the efficacy of fire-extinguishing appliances. Inherently, a ship, especially a passenger ship, is substantially a series of flues which are well adapted to spread fires, and the 1929 convention, by requiring divisional fire-proof 'tween-deck bulkheads, did much to render passenger ships more safe.

Fire detection and extinguishing appliances were also required, but many owners went far beyond these requirements and these improved practices were consolidated in the 1948 convention where three alternative systems of fire-resisting construction were permitted. In addition to the requirements for divisional fire-proof bulkheads, all cabins had to be constructed of fire-resisting material, or an automatic sprinkler and fire-alarm system had to be provided, or a combination of the two systems could be accepted. The three systems represented substantially the U.S. British and French practices, respectively, and all of them have proved their efficiency.

Ever since the loss of the MORRO CASTLE by fire, the U.S. authorities have placed great weight on fire prevention, and we may expect that this view will persist during the coming weeksof meetings. As with subdivision, however, there seems to be little evidence to suggest that a more severe standard is required. Fundamentally, everything depends on the human element: if there is irresponsibility, or lack of discipline, then the danger of fire is enhanced.

LIFEBOATS AND LIFERAFTS.

The last line of defence against loss of life at sea is the lifeboat and liferaft equipment, and here the British Government has a long record of useful legislation. Even before the TITANIC disaster the idea of boats for all was being considered, and it is not surprising that at the 1914 conference this matter was very prominent. At that time, the emphasis was on the number of boats and not on the means for launching them. This aspect was rectified at the 1929 Conference, however, when attention was paid to the necessity for utilising the maximum available length of the ship for the accommodation of boats directly attached to davits, in distinction to methods of stowing which at that time often resulted in over-crowded boat decks. As a result of the new rules, lifeboats were increased in size and improvements were made in the mechanical davits required for launching them. These requirements were consolidated in the

1948 convention, under which more motor lifeboats had to be carried and where greater attention was paid to equipment of lifeboats and means of embarkation.

The 1948 convention also was extended to apply to cargo ships, where gravity-type davits were required in ships over 150 ft. long in place of the old radial davits. Since that time, the inflatable liferaft has been developed, and this is an important improvement in life-saving appliances. It is obviously much more efficient than any other type of liferaft, and, in its capacity as a means for survival of the passengers and crew after a disaster, completely supersedes open boats. Unfortunately, it cannot be used instead of the older appliances, as it is not mentioned in the convention, but without doubt this anomaly will be removed in the forthcoming convention.

Here is an important example of the difficulty associated with international conventions of this kind. To ensure uniformity of application, they must be precise in their requirements, and this in its turn inhibits progress. The mechanism for altering requirements is so slow and complicated that in general nothing is done to take advantage of new techniques and developments. If the new set-up, under I.M.C.O., can alter this state of affairs, then the change will be very beneficial.

RADAR PROBLEMS

In an article in 1945, FAIRPLAY called attention to the need for a conference to revise the 1929 convention, it being suggested that the introduction of radar to merchant shipping would not be long delayed and that it would alter the technique of navigation. The prophecy has been fulfilled to an extent which few people would have thought possible only fifteen years ago. As was to have been expected, problems have arisen, especially in regard to the International Collision Regulations. The chief points of uncertainty are the weight which has to be given to radar in regard to navigation in conditions of poor visibility and with regard to lookout.

A conference was held in London in 1957 to discuss the avoidance of collisions at sea and in the air, and proposed amendments have been suggested which would make it quite clear how the use of radar should be regarded in these circumstances. These amendments which are likely to be adopted should do much to clarify the responsibilities of the seaman and to reduce the risk of collision.

Unfortunately, radar has not had the effect of reducing collisions that might have been expected; but, on the other hand, if radar had not been brought into universal use, it is very probable that, with the greater number of fast ships on the seas, collisions and groundings would have been very much more frequent than they are. We may expect that, with clearer principles laid down for the guidance of seamen, and with a new generation growing up who have been accustomed to radar for all their professional career, there will be in the future an increasing measure of safety arising from the use of radar.

THE DAWN OF NUCLEAR PROPULSION.

The most important marine development since the last international safety convention is undoubtedly the introduction of nuclear power for merchant ships. The Russian ice-breaker Lenin has now been completed and she will be followed by the U.S. ship Savannah, while the British Government have taken steps to secure tenders for a nuclear-propelled tanker of 65,000 tons deadweight. This new motive power has brought with it problems of a kind which have not hitherto been encountered in ship

propulsion, and it is evident that safety regulations of a very strict kind must be enforced.

The report of the committee concerned with the safety of nuclear-powered merchant ships, presented in February to Parliament by the Ministry of Transport, defined very clearly the official point of view. Recommendations have been made regarding the construction, operation and general safety requirements of nuclear-powered ships, not only as they affect the ship itself, but also as they affect the ports visited by such ships. The problem is an international one, of a complexity never encountered so far, and international agreement is therefore necessary. In distinction to other problems affecting safety of life at sea, there is little experience on which to frame regulations. The matter has had to be approached from first principles and from the analogy of land-based reactors. Having in mind the fact that, in the early future, nuclear-powered ships are likely to be few in number and that important advances are likely to be made, the committee very wisely directed their recommendations to an initial period of 10 years or so, and have suggested that the appropriate procedure will be the framing of a series of international "recommendations" rather than the early adoption of an international convention in binding terms to which many Governments might find it difficult to subscribe at this early stage in the development of suclear propulsion.

The effect of this will be to enable decisions on the acceptance of individual nuclear ships in the ports of different countries to be reached bilaterally between Governments. Arrangements of this nature will be pursued at the forthcoming conference, and it is interesting to note that the committee stressed that neither the procedures which they invisage nor the constructional or other requirements recommended should be regarded as inflexible, since to regard them as such, and write them into a convention, would probably hamper future developments.

U. K.'s PROPOSALS.

This brief survey of developments in life-saving regulations demonstrates that the present position, in principle, is very satisfactory, and this is shown by the very small loss of life at sea. In fact, it can well be argued that a passenger is safer on the high seas than anywhere else, though undoubtedly there are some improvements which can be made.

The annual report of the Chamber of Shipping of the United Kingdom for 1959-60 stated that complete agreement had been reached between the industry and the Ministry of Transport on the U.K. proposals to be made next week. The outstanding features of the proposals included provision for the wider use of inflatable liferafts; improved measures for fire detection and extinction in cargo ships; the survey of the hull and machinery of cargo ships, without duplicating the requirements of the classification societies; the introduction into the grain rules of a relaxation for ships which conform to a specified standard of stability; limiting the application of the grain rules to ships carrying quantities of grain using approximately two-thirds of the ship's grain capacity; and the revision of the International Regulations for Preventing Collisions at Sea, with special regard to the utilisation of information obtained from all available navigational aids, including radar.

From this report it is evident that the convention will be extended to cargo ships to a greater extent than formerly, and if this tendency is allowed to gather momentum, cargo-ship owners will in the end be faced with requirements including, undoubtedly, sub-division requirements comparable to those enforced in passenger ships. This will entail additional surveys, both

during and after construction, and in the end will not be to the advantage of British shipping. It is quite easy to lay down a uniform standard in these matters, but less so to ensure that they are applied conscientiously throughout the world.

REGULATIONS AND FLEXIBILITY.

At present, reliance is placed on the classification societies to see that cargo ships are well constructed and maintained in good condition, and it would be unfortunate if there was any duplication of this work.

Each new convention has imposed new conditions on shipowners. On the whole, these conditions have been necessary, but now an exceedingly high standard of safety of life at sea has been attained. Except in small points, there is no need to make any extensions in safety requirements; in fact, the chief aim of the convention should be to allow flexibility, so that new improvements can be adopted. In this country, general practice has always been slightly ahead of Governmental regulations and this process is likely to continue. From every point of view, a uniform international standard is desirable, but U.K. owners should be alert to see that, in an effort to obtain this, they are not penalised by an extension of the authority of the Ministry of Transport into spheres where that extension is superfluous.

They must bear in mind, also, that, as the report of the committee concerned with the safety of nuclear-powered ships said, in a similar context, "experience shows that provisions which are once embodied in a convention tend to be regarded as the natural order of things and are not easily modified."

APPENDIX No. 11.

LIST OF HEADINGS FOR A RECORDS SYSTEM BASED ON THE UNIVERSAL DECIMAL CLASSIFICATION.

	U.D.C. NO. (FILE NO.)	U.D.C. SUBJECT HEADING	COMMENTS
GENERAL	620	General & Alterations.	
	620.19	Defects. - Voyage Repairs.	
	620.197	Corrosion Protection - Paint Schemes. - Cathodic.	
	621 - 7	Maintenance. - Statutory Surveys. - Safety - Classification Lloyds 4 Yearly. Lloyds Annual - Loadline. - Equipment. - Company Requirements.	
SHIP	629.12.01	Ship's Hull.	
	629.12.011	Superstructure.	
	629.12.011 .5	Space Allocation - Accommodation.	
	629.12.012	Cargo Working Gear.	
	629.12.013	Securing & Coupling Gear - Cables, Hawsers.	
	629.12.014 .2 .5 .6 .7	Manoeuvring Devices - Sails, Masts, Rigging. - Steering, Helm, Tiller - Rudders. - Stabilisers.	
	629.12.015	Docking & Mooring Gear - Anchors, Fenders.	
	629.12.016		
	629.12.017		
	629.12.018	Observing & Signalling Equipment. Lights, Communication & Identity Marks.	
	629.12.037 .04 .042 .05 .053	Propeller propulsion. Furnishings, gangway, fittings. Berths, bunks, seating, seats. Instruments, indicators, navigation, etc. Position, Speed, etc.	

SHIP	.06	Services, pipes, etc. Lighting, heating, Air conditioning, Pressure Systems.	
	.066	Electrical Services.	
	.07	Special Characteristics, Performance etc.	
	.071	Dimensions, Weights, Tonnage, etc.	
	.072	Speed.	
	.073	Stability.	
	.074 .074.1 .074.2	Seaworthiness. Lifesaving. Firefighting.	
	.075	Manoeuvrability. Controllability.	
	629.125.5	Lifeboats. Liferafts.	
GALLEY	643.3	Galley & Catering Equipment.	
	643.4	Saloon & Messrooms.	
	643.5	Washrooms.	
	644	Heating, Ventilation, Water.	
	645	Furnishings.	
	648	Laundry & Washing.	
ENGINEERING	662	Fuel - Coal - Oil.	
	621.08	Engines - Generally.	
	621.12	Main Engines - Steam.	
	621.12.1	Auxiliary Engines-Steam.	
	621.101	Steam Boilers.	
	621.17	Steam Auxiliary Plant	Steamships Only.
	621.182	Fuel Firing -Coal/Oil.	
	621.183	Steam Boiler Mountings.	
	621.187	Boiler Cleaning, Water Treatment.	
	621.313.12	Electric Generators	
	621.313.13	Electric Motors.	
	621.313.3	Switchgear.	
	621.315	Electric Wiring.	
	621.32	Electric Lamps.	

ENGINEERING	621.395	Electric Telephony	
	621.396	Radio Communication.	
	621.396.96	Radar	
	621.397	Television.	
	621.4	Diesel Oil Engines, Main.	
	621.43	Oil Engines. Auxiliary.	
	621.43.031	Supercharging.	
	621.43.038	Engine Oil Fuel Injection	Motorships Only.
	621.55	Engine Alarms & Shutdowns	
	621.51	Air Compression & Distribution.	
	621.56	Refrigeration	
	621.6	Pumps, Pipes & Valves	
	621.7	Workshop Practice	
	621.83	Gearing, Transmission.	
	621.85	Transmission Drives (Flexible) Transmission Fluids.	
	621.89	Lubrication-Oil	
	621.928	Oil Separators & Filters	
GENERAL	641	Victualling	
	656.6	Cargo Records.	
	657.4	Accounts.	
	658.3	Personnel.	

schooner and used her sails as well as her engines for propulsion as did most steamers of this period including those of the Royal Navy.-

"EXPRESS" was still operating in 1860, in fact she was not sold until 1874 when replaced by the "DESPATCH" - also an iron screw steamer built on the Clyde by Mr. Parker. Her nett tonnage was 267 tons. Her compound engines developed 50 H.P. Mr. Parker had by this time become an independent shipowner by purchase of a half share in "EXPRESS" in 1855. Later Captain Webb who had relieved Captain Howard Smith in command of "EXPRESS" bought out the latter's remaining half share when Captain Howard Smith, wishing to enter the inter-colonial trade purchased s.s. "YOU YANGS" and thus founded the Howard Smith line in 1854.

Captain Webb and another business man, Mr. John Traill were thus associated with Mr. Parker in the ownership of the "EXPRESS" - an ownership which in conjunction later with Captain Peter Huddart and his nephew James Huddart became the Huddart Parker Line in 1876. Before this amalgamation James Huddart was in business in Geelong as an importer of coal and an exporter of general produce. He owned sailing ships for this purpose. They were mainly iron barques - such a one was "CONFERENCE" - 399 register tons - 164.8 ft. x 26.3 ft. x 15.9 ft. built in England in 1855. This ship was purchased second-hand as was Captain Howard Smith's "YOU YANGS" of 457 tons nett and 672 tons gross. Her dimensions were 185.2 ft. x 27.9 ft. Her compound engine was rated at 90 H.P.

In seeking a typical ship to represent the close of this period ending 1875 one again turns to the fleet of the Australasian Steam Navigation Co. Ltd. Appendix 1A includes S.S. "WOTONGA" built in 1876 by Dennys of Dumbarton. She was an iron screw ship propelled by a compound steam engine, cylinder diameters 38" and 66". Her gross tonnage was 997 and nett tonnage 541. Her dimensions were 229.7 ft. x 29 ft. x 20 ft. She carried Lloyds 100A1 classification as well as other classifications.

However, although "WOTONGA" may have been expected to reflect the latest naval architectural achievement at the close of this period, the most successful ship appears to have been S.S. "CITY OF MELBOURNE", an iron screw ship of 615 tons nett 838 tons gross, built by J. & G. Thomson, Glasgow in 1862. Her dimensions were 250.4 ft. x 28.2 ft. x 16.6 ft. She had a most handsome yacht-like appearance with a graceful clipper bow and rigged with three masts and yards on the fore-mast. She was sold in 1897.

Appendix No. 12.

LIST OF ILLUSTRATIONS PRESENTED AS 35 mm SLIDES FOR PROJECTION.

A. SHIP.

1. s.s. "WONGA WONGA" and s.s. "BOOLERANG"
2. s.s. "BURRUMBEET", s.s. "ELINGAMITE", p.s. "NEWCASTLE", s.s. "COURIER", s.s. "COOGEE", s.s. "EXCELSIOR", s.s. "DESPATCH"
3. s.s. "YARRA"
4. s.s. "ULIMAROA"
5. t.s.m.v. "WESTRALIA"
6. t.s.m.v. "WANGANELLA"
7. m.e.v. "WYUNA
8. WHEELHOUSE OF "WYUNA"
9. m.v. "WARRINGA"
10. m.v. "WATAMURRA"
11. DIAGRAMS OF AUSTRALIAN STANDARD SHIPS 1942 to 1950 -
12. TYPICAL "A" (RIVER) CLASS STEAMSHIP
13. TYPICAL "B" CLASS STEAMSHIP s.s. "BARRIGUN"
14. TYPICAL "B" CLASS MOTORSHIP
15. TYPICAL "D" CLASS STEAMSHIP s.s. "DANDENONG"
16. m.v. "KOOJARRA" - W.A. PASSENGER SHIP
17. m.t. "CORHAMPTON" - TYPICAL BRITISH TANKER 19000 tons
18. ARRANGEMENT PLAN OF"CORHAMPTON"
19. TYPICAL "1" CLASS BULK CARRIER, m.v. "IRANDA"
20. TYPICAL LAKE CLASS BULK CARRIER TURBINE PROPELLED
21. TYPICAL LAKE CLASS BULK CARRIER. DOXFORD OIL ENGINE PROPELLED.
22. PASSENGER VEHICULAR FERRY "PRINCESS OF TASMANIA".