Report of the Committee on Shipbuilding in Canada : volume 1 : summary, recommendations and Canada section.

REPORT OF
THE COMMITTEE
ON SHIPBUILDING IN CANADA

VOLUME 1

SUMMARY, RECOMMENDATIONS
AND CANADA SECTION.

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THE COMMITTEE ON SHIPBUILDING IN CANADA

REPORT

1970

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PART I

FOREWORD, SUMMARY AND RECOMMENDATIONS

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THE COMMITTEE ON SHIPBUILDING IN CANADA
LE COMITÉ SUR LA CONSTRUCTION MARITIME AU CANADA
UNDER THE AUTHORITY OF THE
MINISTER OF INDUSTRY, TRADE AND COMMERCE
SOUS L'AUTORITÉ DU
MINISTRE DE L'INDUSTRIE ET DU COMMERCE

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To: The Honourable Jean-Luc Pepin, P.C., M.P.,
Minister of Industry, Trade and Commerce.

The Committee on Shipbuilding in Canada has completed its studies in accordance with the terms of reference and now submits its report on the Canadian Shipbuilding Industry.

The purpose of the report is to provide the basis for future government policy toward the shipbuilding and ship repairing industry as a major component of Canada's overall maritime interests, recognizing that the industry itself has an important role to play.

The report reflects some eight months of enquiry and investigation. Briefs were received from nineteen interested organizations; responses to the Committee questionnaire were received from twenty-three shipyards and visits were made to twenty-four yards; interviews were held with over one hundred and fifty individuals.

All those in the industry, in labour unions, and in commercial and government fields who were approached for information and assistance were generous with their time and knowledge. Major sources of information were your own Department and the Canadian Shipbuilding and Ship Repairing Association.

The Committee wishes to mention particularly the services of the Vice-Chairman, who acted also as Technical Consultant, and of Woods, Gordon & Co. in their capacity as Economic Consultants.

It is the pleasant task of the Chairman to acknowledge the very major contribution made by the Committee members, who brought their diverse experience and points of view to bear, gave unstintingly of their time and knowledge, and whose efforts resulted in the recommendations made for the Canadian shipbuilding industry for the 1970's. It is the Chairman's conviction that the Committee's endeavours are poorly reflected in the report unless it is succeeded by policy and action.

R. Lowery

O.C.S. Robertson
Chairman

R. McArthur

W.H. White
Vice-Chairman

L. Rochette

J.W. Hudson

27th May 1970

FOREWORD

The terms of reference for the Committee on Shipbuilding in Canada were as follows:

> "To examine and report on the rationale for a Canadian Shipbuilding Industry and, without restricting the generality of the foregoing, to enquire into and report upon the following matters:
>
> (a) Canadian shipbuilding and ship repair requirements,
>
> (b) The costs and benefits of present measures of government assistance to the shipbuilding and ship repairing industries,
>
> (c) The necessity, if any, of modifying existing measures or introducing new measures of government assistance."

These broad terms of reference required consideration of many matters relating to the building, repairing, owning, and operation of ships. It was thus desirable that members of the Committee have appropriate knowledge and experience, and this was accomplished by appointing to it four senior shipbuilding industry representatives and a Vice-Chairman who also was thoroughly familiar with Canadian marine matters.

In order that the Committee could reach sound conclusions and recommendations, it was necessary to bring together a great deal of existing information and to develop new information for aspects in which published knowledge was limited. The Committee established a Working Group made up of the Chairman; the Vice-Chairman and Technical Consultant; the Executive Assistant from the Department of Industry, Trade and Commerce; the Vice-President and Executive Director of the Canadian Shipbuilding and Ship Repairing Association; and personnel from Woods, Gordon & Co., the Economic Consultants to the Committee.

The Working Group obtained data and information from four main sources:

- questionnaires to shipyards.
- visits to yards, labour unions and others in shipbuilding and shipping activities and in government departments.
- submissions and briefs from interested parties.
- official and unofficial publications.

The names of the individuals, organizations and sources consulted are given in the Appendices and in Table C-33. Visits were not made to foreign shipyards but information regarding them was obtained from extensive published data and from the knowledge of individual Committee members who have visited numerous foreign yards.

The Working Group proposed, and the Committee agreed, that a ten-year period be adopted for assessing future prospects and developments. This is long enough to give perspective but not unduly removed from the current situation.

The results of the Working Group's activities are presented in the Summary and in Parts II to V of the report. These constitute a detailed, factual consideration of the market, technological, economic, policy, and competitive aspects of shipbuilding and shipping in Canada and in the Atlantic, St. Lawrence, Great Lakes and Pacific Regions, together with recognition of new developments off-shore and in the Arctic.

In arriving at its recommendations, the Committee had the benefit of the information from the Working Group, together with its own knowledge of the shipbuilding industry, of shipping circumstances

in Canada and elsewhere, and the numerous helpful representations that were made to it, formally or informally, by interested parties.

While being aware of varying points of view, however, the Committee was also conscious of the duty imposed on it by the terms of reference and has sought to make recommendations that would provide a sound basis for a shipbuilding and ship repairing industry appropriate to Canada's requirement for such an industry. Also, although it was aware of regional and individual yard situations, the Committee endeavoured to take a national viewpoint, in line with its conviction that effective performance by the industry is more likely to be realized within the play of competitive market forces, rather than through complex special provisions and administrative decisions.

For these reasons the Committee has made its recommendations as simple and as straightforward as possible. There is little that is new or startling in them; one or another of the world's shipbuilding countries has considered or implemented virtually every possible policy device with regard to shipbuilding and ship operating, and the Committee has not been able to uncover any magic formula for the Canadian situation.

The Committee does consider, however, that the recommendations it makes are those that are most appropriate to Canadian circumstances. At the same time, it wishes to stress that in its view they are the minimum required for the Canadian shipbuilding and ship repairing industry to survive and to develop effectively. As such,

the recommendations if implemented will constitute a severe challenge to the industry to improve its own operations.

The Committee hopes that the government will translate the recommendations into policy and programmes at an early date in recognition of their importance and urgency.

SUMMARY AND CONCLUSIONS

This section presents a brief summary of the principal aspects that have been developed in the body of the report and the conclusions drawn by the Committee which formed the basis for its recommendations.

More complete information is given in the Canada section, and further detail is available in the sections for the Atlantic, Great Lakes and St. Lawrence, and Pacific regions.

The Canadian Shipbuilding and Ship Repairing Industry

The building of ships is the principal activity in the Canadian shipbuilding and ship repairing industry. In recent years new building has been more than one-half of the industry's total activity and has been an even greater proportion in some regions and yards.

Repairs to Canadian and foreign ships engaged in domestic and export trades have been about one-fifth of industry activity, these being carried out both in conjunction with and separate from shipbuilding operations and again constituting a more significant part of total activity in certain regions and yards.

The balance of activity in the Canadian industry as a whole has been manufacture of industrial products, a very large part of this work being carried out by a few companies in the St. Lawrence region using facilities that are essentially separate from their shipbuilding and ship repairing operations.

Within new construction, some one-third of the value of work in 1958-69 has been for government naval and civilian vessels, these latter including a wide range of vessel types for a number of government departments. Another one-third of new construction has been in dry cargo ships, particularly in vessels that were specially designed for the new trading conditions that followed the opening of the St. Lawrence Seaway in 1959. The balance of new building was in a wide range of other ships including tankers, ferries, fishing vessels, barges and tugs, and -- most recently -- drill platforms.

The shipbuilding industry in Canada exhibits certain characteristics that are common to shipbuilding industries elsewhere, including a high unit value and a correspondingly long production period for its main product, and instability of operations because the timing and flow of orders inhibits reasonably stable yard work loads and results in sizeable fluctuations in employment.

However, the Canadian industry has had specific features that derive from its particular circumstances. The main influences on the industry's operations have been the limited size of its market and the wide variety of ships it has had to build. Cost differentials have generally precluded it from selling abroad; its commercial market has thus been in ships for Canadian coastal trades (in competition with Commonwealth built ships) and for trades with the United States through the Seaway and Lakes and on the Pacific Coast (in competition with ships built in any foreign country). Under these circumstances

government orders have been very important for the industry and have been keenly sought after. The result has been the presence of very active competition among yards for commercial and government new construction business, and a willingness to contract for this work at "below normal" margins in order to have a basis for continuing operations and being able to carry out other, more profitable, repair, conversion, and industrial business.

Accompanying this competition in price and delivery terms has been the need for yards to be able to design and supply any one of a wide variety of ships. The nature of demand has been such that most Canadian building has been one of a kind and the industry has thus not been able to realize benefits arising from series production (except to a certain extent in the construction of fairly standard lake and seaway ships in some yards).

These particular characteristics of Canadian shipbuilding have had a significant effect on the operating practices in the yards. Yard managements have continually had to take a balanced course of action between specialization for maximum efficiency and flexibility for adaptation to the varied market conditions.

Other effects on operations have arisen from the strong trade demarcation provisions in the labour contracts or traditions at many Canadian yards. These limit flexibility in labour skills and contrast with reported movements in Japan, Sweden and the United Kingdom toward lessening of demarcation and introduction of flexibility agreements.

The limited market for Canadian ships and the relatively small number of Canadian shipowners has had an effect on the marketing and selling function within the shipbuilding industry. Captive business has been important and customer contact has generally been maintained by senior company executives. A consequence of the wide mix of ship types has been the employment by the larger yards of their own naval architects, engineers and support staffs who also take part in sales and promotion activities. There is also extensive use of marine consultants by smaller yards. Industry and government professionals in Canada have made substantial contributions to research and development in marine fields, which have been internationally recognized; in turn, they have had access to and made use of research and development findings in other countries.

The general range and standard of building facilities (launchways, docks, cranes, etc.) in major Canadian shipyards are comparable to the facilities in similar sized shipyards in the United States, United Kingdom, Sweden, Japan and other countries, and correspond broadly to the domestic ship requirements that have prevailed. Canadian yards cannot, of course, be compared with foreign yards built to supply giant bulk carriers. Generally speaking, methods in most major and intermediate yards in Canada compare favourably with those used in similarly sized yards elsewhere.

All major Canadian building yards also engage in ship repair operations. Substantial combined ship repair and industrial operations (without shipbuilding) are carried out at two locations,

and there are a number of purely repair operations on both coasts and in the Lakes and St. Lawrence that provide repair services afloat.

With regard to economic aspects, the Canadian shipbuilding and ship repair industry is among the less capital intensive and more labour intensive Canadian manufacturing industries. New capital expenditures in the industry have been relatively less than in manufacturing industries generally, but the level of maintenance expenditures has been higher because of the nature of the assets and of activity in shipbuilding. The age of major assets in the industry is greater than in all manufacturing because shipyards require relatively more investment in basic "plant" with an extra long life, although there have been sizeable investments by individual yards in recent years. Further major investments would be encouraged by market and policy conditions that would enable yards to take a longer view than they have been able to in the past.

As would be expected in a labour intensive industry, value added per dollar of labour cost has been below the average for all manufacturing industries. Wages paid per man-hour have been somewhat above average, reflecting in part the higher than average degree of skill required in the industry. Growth in wages per man-hour in 1961-66 was similar to that in manufacturing industries generally.

Value added per man-hour in shipbuilding and repairing is lower than in all manufacturing but has been increasing more rapidly. In 1961-66, output per man-hour assessed on this basis

increased one-third faster in the industry than in all manufacturing, measured in current dollars, and more than twice as fast when expressed in terms of constant dollars.

From the data examined, it appears that shipbuilding and repair prices have declined in relative terms while those of most other industries have risen, and thus part of the industry's improved productivity has been reflected in prices to shipowners.

Many factors underlie this increase in productivity, but undoubtedly the greatly increased scale of operations that became possible for the industry in the 1960's was most significant. This fact has important implications relative to the industry's future prospects and viability.

It would have been desirable to assess the economic performance of the Canadian shipbuilding and repair industry in comparison with that in a number of other countries, but comparable data exists only for the United States industry. In relation to that country, the Canadian industry invested relatively more capital in 1961-66 and increased its wages paid per man-hour at a faster rate. Value added per man-hour in constant dollars, i.e. productivity, grew more than three times as fast in the Canadian industry than in the United States industry.

It would also have been desirable to have an assessment of the relative competitiveness of the Canadian industry by comparing prices and costs for actual similar ships built in Canada and in other countries. Many efforts have been made in other studies of national shipbuilding to make such comparisons, but with limited

success. The Committee applied considerable effort to this matter and concluded that, despite average productivity in Canadian shipyards being some 10-15% higher than in U.K. yards, the differentials in wage rates and material costs result, under present conditions, in average prices of U.K. built vessels being some 25% to 30% less than average prices for vessels built in Canada. While recognizing the difficulties and limitations in such an assessment, including regional cost and price differences within Canada, the Committee considers that this reasonably portrays the broad magnitude of the differentials that exist vis-a-vis Canada's most important competitor in shipbuilding.

The Effects of Government Policies

Policies of the Canadian and of foreign governments have been important influences on the operations of the Canadian shipbuilding and ship repair industry in the past and will undoubtedly have significant effects in the future.

Canadian government policy toward the industry has been evident in three main aspects:

- procurement
- protection
- fiscal and other arrangements.

Procurement

In regard to ship requirements, the policy has been to build government naval and civilian ships in Canada and this has generally been done. Meeting these requirements has constituted one-third of all new construction activity in the industry in 1958-69, but this

proportion has fluctuated between 22% and 52% and the annual value between $20 million and $55 million. Both the size and variability in Government procurement have been significant in the industry's operations. A firmer indication of the size, nature and timing of future government ship requirements would be useful to the industry for its own long range planning. Moreover, placement of orders so as to lessen fluctuations in demands on the industry would also be of benefit.

Quality assurance programmes are being put into effect for naval work, and the result could be to further concentrate the ability to meet naval requirements into fewer yards - a process that began with the introduction of national competitive tendering in 1965. An assessment is being made by an interdepartmental committee of the desirability of placing all government civilian shipping under one operating authority; this presumably could have the effect of lessening government new ship requirements and of adoption of procurement practices that would enable shipbuilders and marine suppliers to perform more effectively. The Committee understands that policy regarding naval dockyards is also being examined by an inter-departmental group; the significance for the shipbuilding industry is the extent to which such dockyards are used and should be used for repair, refit or conversion of naval and non-naval government ships, over and above some level associated with basic dockyard functions in support of the navy possibly restricted by a ceiling on numbers of dockyard civilian personnel.

As is evident, government business and government conduct regarding its requirements for new ships results in very close association between government and the industry. The important matters in this situation are the areas in which such close association should be exercised, and the way in which it can be most effectively carried out in the market, competitive and technological conditions foreseen in the future. Industry - government relations have not always been fully satisfactory in the past; modification in attitudes is desirable in the future.

Protection

The Canadian shipbuilding industry has not benefited from effective tariff protection, since Commonwealth (principally U.K.) built ships have been able to enter Canada duty free (although there is a 25% tariff on the import of other foreign built ships). Moreover, Canadian shipbuilders have been at a disadvantage compared to U.K. shipbuilders in respect of duty free entry of components since May 1966, when the general Canadian drawback regulations were withdrawn (although duty free entry of certain products is permitted under particular provisions).

This tariff practice for ships - duty on components, no duty on the end product - is at variance with Canada's regular tariff structure. In light of the Most Favoured Nation rate of 25% that prevails on import of ships, an appropriate British Preferential rate might be 20%.

In the absence of effective tariff protection and in view of changes in ship requirements following the opening of the

Seaway in 1959, construction subsidies to encourage the building of ships in Canada were introduced in 1961. The initial underlying purpose of the subsidy was to equalize average costs between Canadian and United Kingdom shipyards. Revised policy announced in 1966 changed the function of the subsidy toward a protective device. Under the new policy of a declining subsidy rate, the 17% level (which would be reached in 1973) would be approximately equivalent to a 20% tariff. Protection by subsidy rather than by tariff has the effect of keeping the prices of Canadian shipping services below what they would otherwise be. It also spotlights the costs of protection, since subsidies are readily visible whereas the effects of tariffs are not.

It might be noted at this point that reservation of coastal trades in certain areas to Canadian flag vessels does not have any direct protective benefit to Canadian shipbuilders, since Commonwealth built vessels readily qualify for Canadian registry and sail in this coasting trade.

Fiscal and Other Arrangements

Certain government fiscal measures for shipowners have operated to benefit shipbuilding in Canada. These include capital cost allowances at 33-1/3% straight line per annum for Canadian built vessels and exemption from taxation of recaptured depreciation on disposal of a qualified ship provided the proceeds of disposition were to be used for construction or conversion in Canada of another Canadian ship under conditions satisfactory to the government. The combined effect of these provisions has been to provide funds for a substantial

part of Canadian commercial shipbuilding in post-war years. Conventional mortgage financing has not been required to any major extent.

However, the profit position of shipowners has not always allowed them to take full advantage of fast write-offs. Present high interest rates and scarcity of commercial financing could act as barriers to the building of new ships. Another factor concerning the financing of new building is that the present replacement provisions terminate after 1973. There will probably be need for review of the financing arrangements for the purchase of Canadian-built ships.

General government programmes and policies relating to research and development have not benefited shipbuilding to the same extent as other industries, e.g. aerospace, because these programmes have not been particularly applicable to the industry's circumstances. It would seem that, for the general run of ship, neither the design nor production stages provide significant scope for qualifying scientific or technological innovation, and that the most promising areas for change in Canadian shipyards are in facilities, layout, planning and organization of basic production flow and processes. To improve its facilities and operations, the industry needs assistance that is production oriented; what is required is not adequately provided for in existing programmes.

It should be noted that almost all countries assist their shipping and shipbuilding industries in some manner and to greater or lesser degrees. The list of types of direct and indirect subsidies, aids and grants that are used in different countries is

long, and a number of other social, economic and political types of assistance have had an impact on the competitive factors involving maritime activities. Government assistance and intervention being the rule rather than the exception has tended to encourage retaliation in assistance measures. Recently a number of shipbuilding countries have agreed on the maximum terms to be extended by governments in export credits.

The magnitude and prevalence of government aid abroad should be fully recognized when framing Canadian policy. The situation in the United Kingdom is particularly relevant because of its position as the major competitor to Canadian shipbuilders. In that country, qualifying shipowners are paid a subsidy of 20% of the cost of new vessels, with depreciation up to the capital cost of the ship to the owner to be taken at any time. Shipyards are paid investment grants toward the cost of new productive equipment; the rate is 40% in the areas where most of the major yards are located (45% in one area). Loans are made for ship purchases from qualifying yards; such loans are up to 80% of ship value for eight years at an effective interest rate of 6% (compared with commercial rates of some 9%). Shipyards are paid by the government 2% of the value of new building (both for export and domestic) in compensation for indirect taxes. There is duty free import of all components used in ship construction. Grants and loans toward industry modernization have been made by the U.K. Shipbuilding Industry Board. Taken together, these measures constitute a powerful package of assistance to shipping and shipbuilding in the United Kingdom.

The Potential of the Canadian Shipbuilding Industry

The estimated current potential output of the Canadian shipbuilding industry is 370,000 gross registered tons per year. This estimate is based upon the industry producing a mix of vessels as in the past rather than specializing in particular types of ships.

Average output during the 1958-69 period was 151,000 GRT per year. In the more recent 1965-69 period, average output was 189,000 tons a year but when it is recalled that several yards were in operation then that have since ceased building, the industry was evidently operating at about 50% of its capacity in recent years.

A detailed projection has been made of the prospective demand for shipping services and ships, including commercial requirements for coastal and inland fleets, together with fishing vessels and government naval and non-naval requirements insofar as these are known at the present time. The commercial forecasts are considered reasonable as a basis for assessment. Any projection of ship demand from the fishing industry is very difficult because of underlying uncertainties regarding the development of this industry's future operations. The forecast for government requirements - for naval vessels in particular - is also uncertain and amounts to only 6% of total tonnage projected for the 1970's compared with 11% during 1958-69.

Given these circumstances, the indicated overall requirements are in the range of 175,000 to 180,000 GRT per annum during the 1970's, but not all of these ships will necessarily be built in Canada.

In the Pacific region where the indicated commercial requirement is 53,500 GRT per annum, mainly in tugs and barges, the increased size of these vessels and the zero duty on imports from Commonwealth sources, e.g. Singapore, indicate that Pacific yards may not necessarily retain all of what so far has been a traditional market for them. Moreover, it may be noted that production of barges requires fewer labour skills and has a lower total value than work on self-propelled ships.

The major portion of the projected commercial demand of 96,000 GRT per year for the Great Lakes and St. Lawrence regions is expected to be in bulk carriers. It appears likely that there will be relatively little demand for new ships during the next 2-3 years, with a heavier demand in the later years of the 1970's. Again, there are a number of factors that may reduce business for Canadian yards. The present reducing subsidy rate in Canada and the high cost of money compared to the credit terms available in the United Kingdom could result in orders for new ships being placed there. Further amalgamation in Canadian inland shipping companies may have the effect of somewhat lessening the demand for new ships. The introduction in the near future of 1,000 foot U.S. upper lakers could have an adverse effect on the market for the services of the Canadian inland fleet, as might changes in U S. government policy toward its lakes fleet.

The forecast commercial new ship requirement of 12,800 GRT per annum for the Atlantic region is likely to be mainly in tugs and barges, and these also could be Commonwealth rather than Canadian

built in future years.

The total 176,400 GRT annual potential demand for new construction during the next ten years would represent an estimated operating rate of 48% of capacity for all yards in Canada. If all government new construction requirements were to be placed in the Great Lakes, St. Lawrence and Atlantic region yards during the 1970's, the potential demand for Pacific region yards would be 53,500 GRT per year or approximately 42% of the total estimated capacity in that region. The other regions might have a potential demand of 122,900 GRT per year or approximately 51% of their total estimated capacity. Both calculations presume that all the vessels required would be built in Canadian shipyards.

The estimated current potential capacity for shipyards in all regions is based on current productivity, and does not take into account possible increases in productivity over the next ten years even without major changes in existing facilities. Any such increases in productivity would have the effect of lowering the operating rates in the yards.

All the above factors suggest that the yards in the Pacific region, if all federal government new construction is carried out elsewhere in Canada, may have an operating rate of something less than 42% during the next ten years. For the Great Lakes and St. Lawrence yards the position would appear to be somewhat more favourable since they could achieve a 51% operating rate by building 78% of the commercial demand projected for their regions and 60% of the government

and fishing vessel demand; here also, however, competitive developments and productivity increases would act to lessen operating rates and there is the possibility of particularly low demand in the early 1970's. In the Atlantic region the yards would need to build 22% of the Great Lakes/St. Lawrence region requirements, 40% of the government and fishing vessel demand, and all of the Atlantic region demand to achieve a 51% operating rate which, again, could well be lower.

While a consistent average operating rate of the order of 75% would be considered satisfactory in the industry, rates of operation at the indicated levels are much too low for attainment of a high degree of productivity.

It is necessary to consider means of increasing operating rates in the industry as a whole. Essentially, the options are to increase volume or to reduce capacity (or a combination of these).

Increased volume could be available from five principal sources: exports, new developments off-shore and in the Arctic, reserving of the coast to Canadian built vessels, establishment of a Canadian built, Canadian flag, deep sea fleet, and further involvement by the industry in non-marine, heavy industrial work.

Possibilities for exports appear to exist in specialized naval, oceanographic and research vessels, in the design and construction of which the Canadian industry has considerable knowledge and expertise. Measures by the industry and government to improve the prospects for exports could well be directed to these specialized types of ships and markets, including provision of such vessels in foreign aid programmes.

There may well also be opportunities for Canadian yards to take advantage of special export situations arising from long delivery times in foreign yards for commercial ships of the type and size that Canadian yards produce. Major capital expenditures on new facilities for series production of such ships for world markets would not appear to be justified without additional assistance, since even with the increases in productivity that would be realized, labour and material cost differences would likely preclude Canadian yards being fully competitive on a permanent basis. Nor would it be feasible to undertake the even greater capital expenditures that would be needed to establish new, fully automated facilities of the kind in operation elsewhere, to produce giant tankers and bulk carriers. Such a yard in Canada would be competing with established yards that already have more than enough capacity to supply world requirements for ships of these types, and would still be subject to adverse wage and material differentials. These large vessels will, however, be entering Canadian waters to an increasing extent, and repair facilities to service them will be necessary. Provision of required drydocking facilities in conjunction with changes to existing building facilities, could increase substantially the size range of vessels that can be built in Canada and that may be exported under favourable demand conditions.

Perhaps the principal possibility for increased volume arises from new off-shore and Arctic developments. The Canadian industry already has, or could readily acquire, the production and technical capabilities to meet requirements for marine equipment and vessels in these areas. Government policy regarding sovereignty

and the terms and conditions under which non-Canadian suppliers and operators may be permitted to participate in these developments are most significant in light of the relatively limited demand that will likely exist for the shipbuilding industry in its traditional markets.

A third possibility would be reservation of the coasts to Canadian built ships. This would have a limited immediate effect on shipbuilding since most ships in existing trades have been built in Canada in the last ten years. Such reservation would, however, ensure that all new vessels were built in Canada rather than in the Commonwealth, and this could be particularly significant in relation to ships for Arctic and other new trades.

The fourth possibility for increasing volume would be the supply of Canadian built vessels to a Canadian flag deep-sea fleet. The benefits and costs of operating such a fleet are being studied by the Canadian Transportation Commission, assuming that ships for the fleet are available at world market prices. If justification is found for such operations, the conditions needed for the ships to be built in Canada require consideration since the potential volume would be significant for the Canadian shipbuilding industry.

Finally, increased volume for the shipbuilding industry may be possible through expanded manufacture of heavy industrial, non-marine products. To do this on a sizeable scale, however, and

to be competitive with large, well established heavy industrial firms, the shipbuilding industry would have to invest in special facilities that would be, to a large extent, separate from their shipbuilding operations. A few yards do operate in this manner. However, the majority of yards are not located in areas with extensive industrial bases where there are broad markets for semi-finished and finished products. While yards will undoubtedly attempt to increase their industrial work, this is unlikely to be more than a supplement, generally, to their main activity of shipbuilding and ship repairing and would make use of common rather than special facilities.

Turning now to consideration of decreasing capacity by closing down some yards, the effect would be to concentrate new construction in fewer yards, thus increasing their operating rates and achieving higher productivity. This would improve the situation in new construction but there could be problems in maintaining adequate ship repair capabilities in some areas because of the geographic extensiveness of Canadian shipping services, the distances between shipyards, and the variety of demands for repair services.

In light of the prospective supply/demand balance for the Canadian industry, it appears that some further contraction in the number of yards is inevitable in addition to what has occurred in the last few years. Major shipbuilding facilities at strategic locations on the coasts and inland waterways could concentrate on the efficient production of larger sized vessels for the domestic market and possibly for export, and could supply ship repairing services in conjunction with independent ship repairers. A limited number of

smaller shipbuilding yards could supply smaller-sized vessels to the domestic market (and abroad, if possible) and would meet local requirements. These developments are likely to occur through natural attrition without need for intervention.

The Costs and Benefits of Present Measures of Government Assistance to the Canadian Shipbuilding Industry

Precise assessment of costs and benefits is never an easy matter, and in respect of the Canadian shipbuilding industry is complicated by the multiple objectives underlying government assistance policy, by the number of means through which assistance has been provided, and by the difficulty of assessing related benefits.

Thus one aspect of government assistance is its policy of procurement in Canada. It is to be noted, however, that this appears to be related to national policy considerations of independence and sovereignty as well as to considerations of industry support, and these benefits are difficult to quantify. Moreover, in order to assess the cost of such support, it would be necessary to attempt to measure the price premium which government might have had to pay for Canadian built ships over foreign built ships in past years. This is a hypothetical exercise which would require a substantial number of assumptions of questionable validity, and no meaningful comparison of benefits and costs can be made in respect of this aspect of government assistance.

Again, it is not possible to assess the costs to the government of the special fiscal measures which have been and are available to shipowners for purchase of ships. Essentially, such costs

arise from deferment of taxes. The Committee concurs with the government interdepartmental committee that concluded in 1965 that such effects could not be calculated with any degree of confidence.

In these circumstances, the costs to the government are generally considered to be the subsidy disbursements that have been made, totalling $235 million during the fiscal years 1961-62 to 1968-69. However, given that there is no tariff protection on U.K. built ships but that a 20% B.P. rate would be appropriate, it follows that the first 17 points of subsidy are protection rather than subsidization as such. On this basis, it is calculated that $116 million or virtually one-half of the subsidies that have been paid have constituted protection for the industry to a similar extent as that afforded other Canadian industries. In more recent years, when subsidy rates for both commercial and fishing vessels have been declining, the average protective component in subsidies paid would be higher, although evidence on this is obscured by declining construction activity and by an increasing use of proceeds from disposition rather than subsidy in financing new ships.

It may be noted, too, that subsidies as such are a significant aspect of general government policy. Thus in recent years total government subsidy and capital assistance payments have been close to $600 million per annum, including payments of $100 million per annum to railways in respect of reduced freight rates.

On the side of benefits, difficulties in assessment also prevail. Determination of incidence of benefit can be important for measurement but cannot always be specified. For instance, during 1961-65 when there were Canadian content requirements, part of the benefit was received by Canadian suppliers of materials and equipment. As a further example, the intense competition that has prevailed among yards for new construction has led to price quotations that have yielded "below normal" margins for overhead and profit; in effect part of the benefit went to private shipowners and - it may be noted - to the government in respect of its orders. As a final example, the effect of a zero tariff on U.K. ships and of the Canadian construction subsidy evidently was to provide shipping services in Canadian waters at prices less than they otherwise would have been. The ultimate beneficiaries were the users of services, but measurement of benefit is virtually impossible at this level of diffusion.

Turning to expressions of benefit in terms of resources used in shipbuilding, the labour intensive nature of the industry has resulted in it providing more employment directly and less employment indirectly (through purchase of materials) than the average for all manufacturing industries. During 1962-67 the industry had a reasonably stable level of employment, at about 1.25% of all employment in manufacturing industries. Since then, however, a decline in new construction orders has resulted in a level of employment at the end of 1969 that was the lowest since the early 1950's.

The amount of subsidies paid per man-year of employment has averaged some $2,400 and, recalling that one-half of this is

properly protection, the amount of actual subsidy per man-year has been about $1,200. The employment considered is that in new construction, repair and conversion work, since subsidy not only resulted in jobs in new construction but provided a base for all the marine operations of many yards. The average cost of subsidy in relation to employment in particular localities and regions has depended, of course, on the relative importance of subsidized vessels in the mix of total work carried on, having been above average in some cases and lower in others.

The industry is a significant provider of work in certain areas. Thus in the Atlantic Region, the St. Lawrence, and the Upper Lakes, shipbuilding and repair employment comprises a substantial portion of manufacturing employment in yard locations, and offers virtually the only local opportunities for a wide range of tradesmen and skills.

Were shipbuilding employment not available in these locations, and since many of the yards are in regions of slow economic growth, it might be necessary to use the provisions of programmes being followed by the Department of Regional Economic Expansion to provide alternative manufacturing occupations. Under these programmes, for a new plant or new product expansion, the incentive is up to 25% of capital costs plus up to $5,000 for each job created in the operation, provided the total benefit does not exceed $12 million, or $30,000 for each job created, or one-half of the capital to be employed in the operation.

While the shipbuilding industry is not as large a purchaser of materials as manufacturing industries generally, it is important as a market to marine suppliers of the wide range of its requirements. However, the limited scale of shipbuilding activity in Canada has resulted in a requirement for individual components or items of equipment that has often been too small to warrant manufacture in Canada, and in recent years it is estimated that 40% of the industry's material purchases have been of foreign origin. The extent of such purchases outside Canada evidently increased after the Canadian content regulations that accompanied the earlier subsidy were suspended in 1966.

With regard to other balance of payments implications, there has been relatively little export and import trade in ships as such in recent years, apart from movements connected with transfer of flag. Whether imports of ships will become more significant in future depends on circumstances yet to be seen. The subsidy rate, after being 25% for three years, began to decline at 1/2% per quarter after May 1969; but the effect of this has not yet been experienced because few ships have been ordered during the recent depressed conditions in the market for shipping services. Nor will the effect likely be evident soon, since resumption of orders on a sizeable scale is not expected for some time. When orders resume, and should business be placed in U.K. rather than in Canadian yards, the balance of payments effect will be an indication of the value of the economic activity - in terms of employment, material purchases

from domestic sources, profits, and taxes - lost to the Canadian economy.

Information on the balance of payments for shipping services, though not related to the costs and benefits of measures for shipbuilding, is of interest because ship operations constitute the market for the shipbuilding industry.

For waterborne inland trade (Lakes and St. Lawrence) between Canada and the United States, a balance of payments deficit of $3 million a year in the late '50s was changed to a surplus of almost $20 million in the late '60s as a result of the changed trading conditions and the growth and modernization of the Canadian fleet.

As regards deep-sea shipping, the Canadian flag ocean-going fleet is now of negligible size, although Canadian operators own or charter a substantial number of ships that engage in deep-sea trades under foreign flags. The balance of payments surplus on ocean shipping in the late '40s became a deficit during the 1950s, and this fluctuated around a level just over $100 million during the '60s.

COMMENTARY AND RECOMMENDATIONS

Shipbuilding and ship repairing are significant components of Canadian maritime activities and it is desirable that the range of these activities should fully satisfy Canada's maritime interests.

The Committee starts from the position that a statement of maritime policy is necessary and that this statement should clearly specify those interests and establish the basic rationale for a Canadian shipbuilding and ship repairing industry in relation to them.

It is unquestionable that Canada has very extensive maritime interests. Even before Canada was founded, fishing rights and regulations were an important aspect of the country's sovereignty. They continue to be so today as is illustrated by recent legislation extending the coastal fishing limits.

Early in the present century, Canada decided to have its own naval capability. Initially this was satisfied with ships built abroad; for the last thirty years Canadian naval vessels have been built within the country as a matter of policy.

Over the years, Canada has progressively extended its scale of operations in Arctic seas. Current developments indicate that Canada is on the point of establishing policies relative to the Arctic which will accord with the extent of its jurisdiction and sovereignty, and which will undoubtedly involve significant maritime aspects, with corresponding maritime responsibilities.

The offshore continental shelves adjoining Canada - always important from their fishing aspects - have recently become significant as possible sources of oil and gas, with attendant serious dangers of pollution if exploration and development in these areas is not carried out under proper control, including inspection, by Canada.

The significance of the offshore areas has been commented on recently as follows:*

> The continental shelves (adjoining Canada's coastline) are nearly 40 percent as large as the total area of the country. Since the sea is biologically as productive per unit surface area as the land at similar latitudes, and the continental shelves are geologically of the same composition as the land, this suggests that Canada as a nation cannot avoid an interest in marine activities; indeed, it cannot afford to neglect them. At the present state of world political development, to fail to assert its full sovereign prerogatives with respect to the use and development of this potentially important part of the country, would be to fail in our responsibilities to give future Canadians maximum possible opportunities for self-determination.

The manifestation of past maritime interests is illustrated by the Canadian government naval and non-naval fleets that exist to pursue, support, regulate and enforce Canada's national interests in the maritime field.

The commercial aspects of these interests are equally evident. Thus Canadian fisheries have been protected by restriction of coastal fishing to national vessels except for certain rights of foreign vessels under early treaties.

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* Paper on the Marine Sciences in Canada, prepared by the Study Group of the Science Council of Canada and presented in a seminar at the University of New Brunswick in August 1969.

Cabotage is a common international practice whereby the carriage of goods and passengers from point to point on domestic coasts is restricted to ships registered under the national flag (and, in some cases, notably the United States, also to ships built nationally). In Canada, Commonwealth registration was sufficient for operation in all coastal trades up to 1966; in that year coastal trade on the Great Lakes and St. Lawrence was restricted to Canadian flag vessels without restriction on the country of building.

Many nations take considerable interest in the shipping that is available to service their foreign trade but which may be outside their immediate jurisdiction. This has particular application to Canada, since over one-third of its exports are to offshore destinations. The availability under suitable terms and conditions of efficient international shipping services is thus of great significance to Canada, as is the presence in Canada of repair and maintenance facilities of appropriate size and location to service both international and domestic shipping.

The public policy and commercial aspects of Canada's maritime interests have, in the Committee's view, been inadequately articulated in the past. This has created difficulty for the shipbuilding, ship repairing, ship owning and other maritime industries, since there has not been a stated maritime policy nor a focal point within government which would translate that policy into programmes and would be available for consultation by the various segments of

the maritime industries. The speed and extensiveness of current developments in maritime fields makes the need for policy declaration very immediate.

Accordingly the Committee recommends as follows:

Recommendation No. 1

> That the government develop, formulate and state a maritime policy which will ensure fulfillment of Canada's maritime interests, and that it establish appropriate organizational arrangements for continuous implementation of that policy.

While Canada's demonstrable maritime interests require ships, floating equipment and watercraft of one kind or another, an ensuing question is the extent to which these should be provided by the building and repair of ships within Canada itself.

The Committee, in extensively reviewing this matter, has given consideration to the costs and benefits of the shipbuilding and ship repairing industry in Canada. It has concluded that the market and operating circumstances for the Canadian industry in past years have necessitated a degree of assistance for the industry in excess of the protection afforded Canadian industries generally. There have been economic benefits - for example, in terms of balance of payments effects and of employment in regions of Canada where shipbuilding and repairing is a major source of work. The technical

skills of the industry considered in its widest sense (including yards, suppliers, designers and consultants) have been enhanced, and the industry has been successful in designing and building ships specifically for Canadian conditions and requirements. Additionally, the industry has provided needed repair services which, in certain locations, require that there be a combined shipbuilding and ship repairing facility.

* However, the prime justification for the special assistance given the industry (beyond a normal level of protection) would appear to have been in the sovereignty and national independence aspects already referred to, together with an evident desire that Canadian coastal trade be carried in Canadian ships. In post-war years, it has been policy to place almost all government requirements for ships (both naval and civilian) in Canadian yards and this has represented over one-third of all new construction activity during 1958-69 (the period examined in detail by the Committee). Government requirements, together with assistance toward building of commercial and fishing vessels in Canadian yards, has demonstrated government recognition of the desirability of maintaining a Canadian commercial shipbuilding and ship repairing capability.

However, in the Committee's view, the expression of this recognition up to now has fallen short of a full statement of policy which would provide a framework for the industry itself to plan for the future. Thus the Committee makes the following recommendation:

Recommendation No. 2

That Canadian maritime policy recognize the significance of the shipbuilding and ship repairing industry in relation to Canada's maritime interests, and that it establish and state policies, practices, and programmes that are appropriate for the industry to discharge its functions and meet its responsibilities with respect to those maritime interests.

The effect of government procurement and assistance measures during the 1960's was to increase substantially the scale of industry operations, and this contributed to the advancement of the industry's technical capabilities and to increases in its productivity. The point was reached at which the need of the industry for special assistance (over and above protection) came under examination and, following review during 1965, substantial changes were made at the beginning of 1966.

Whereas the underlying purpose of the shipbuilding subsidy for commercial vessels (other than fishing vessels) had earlier been to balance the differential between Canadian and U.K. shipbuilding costs, the new arrangements contemplated a staged reduction in the subsidy to a level that would correspond to the protection afforded other industries through tariffs. (The duty rate is zero for import into Canada of ships built in the United Kingdom or other Commonwealth countries, so the industry has had

no effective tariff protection. Review of the information available indicates that about 50% of past subsidy payments have been in the nature of protection rather than subsidy as such).

The level of subsidy was set at 25% for vessels delivered during 1966-69 with a subsequent, staged decline to 17% by 1973 (this latter rate being approximately the equivalent of a 20% tariff). At the same time, duty drawback on imported materials and components used in the construction, conversion and repair of ships in Canada was removed.

These provisions were apparently intended to put the Canadian shipbuilding industry on notice that it could not expect an indefinite continuation of special assistance and that it was expected to achieve, principally by improved efficiency, a level of comparative costs such that special assistance (over and above protection) would eventually be no longer needed.

The Committee considers that the general intent of this revised policy was, and continues to be, appropriate for the Canadian shipbuilding and ship repairing industry. During the 1960's, the industry has been able to substantially increase its effectiveness. The Committee is confident that, provided there is a reasonable work load, further increases in productivity will be achieved during the 1970's.

The Committee considers, however, that the timetable developed in 1965 for the implementation of the changed policy with

regard to subsidy is inappropriate to the circumstances that prevail in the industry, some of which could not have been foreseen, and that the removal of duty drawback has had an adverse effect on the industry.

(1) Thus, devaluation of sterling at the end of 1967 created a considerable change in the basic external competitive situation. According to the best estimates of the Committee, the differential in Canadian - U.K. shipbuilding costs is now of the order of 25% to 30%, and had it not been for sterling devaluation the differential would be 20% or less. This reflects the progress achieved since 1961 when the original subsidy was established and indicates that the policy of declining subsidy introduced in 1966 was sound in principle.

(2) A further unforeseen development is that the demand for ships in the traditional domestic markets for the Canadian industry began to decline at about the end of 1967 and has progressively deteriorated since in terms of tonnages on order and employment provided in the shipyards. There is no indication of a reversal in these tendencies in the immediate future.

The Committee cannot state categorically that the industry's position has been damaged by the decline in subsidy rate from 25% to 23% during 1969-70, because few orders for new commercial ships for Canadian trades have been placed recently. However, it is the Committee's best judgment that no further decline in subsidy is appropriate for some time ahead and that the rate of decline should be slower than was originally contemplated.

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The prospective low level of operations will make it very difficult for yards to achieve the productivity improvements that are imperative with declining subsidy -- productivity improvements, be it noted, that must be relatively greater than those that competing yards abroad will undoubtedly be achieving. Moreover, given that the industry is starting the 1970's from a low base of operations, more time will be needed to effect the productivity improvements and to make necessary adjustments.

The Committee is also of the view that the drawback of 99% of duty paid on import of components for ship construction, conversion, or repair that was withdrawn at the beginning of 1966, should be reinstated. Presumably the removal of drawback was intended to recompense to some extent Canadian suppliers of equipment to the shipbuilding and repairing industry, following suspension of Canadian content requirements that prevailed since May 1961.

While the Committee is sensitive to the position of such suppliers, it is also aware that the range of types and sizes of vessels built in Canada has not produced a demand for individual components on a scale generally large enough to support manufacture in Canada. Requirements have therefore been supplied primarily through imports, and the removal of drawback has increased ship prices and has acted to lessen the range of sources of supply since the lower tariff on products of U.K. origin has favoured placing business there.

Virtually all shipbuilding countries allow duty free import of components used in shipbuilding, including the U.K. which

is the principal potential supplier of ships to traditional Canadian markets. In light of this, the Committee considers that reinstatement of duty drawback is desirable for an efficient and competitive Canadian industry.

Accordingly the Committee's basic recommendation relative to the level and timing of protection and special assistance for the Canadian shipbuilding and ship repair industry is as follows:

Recommendation No. 3

> That the level of subsidy on commercial vessels (other than fishing vessels) as defined in the present subsidy regulations, be maintained at 23% for deliveries prior to June 30, 1973, and then decline at the rate of one-half percent every six months until a level of 17% is reached by 1979;
>
> That duty drawback of 99% in respect of components imported for the construction, conversion, or repair of ships in Canada be reinstated forthwith, and in the absence of such action the rate of subsidy be increased by two percentage points.

Protection for the Canadian shipbuilding industry is in the form of subsidy rather than tariff. Subsidies are highly visible whereas the effects of tariffs are diffused throughout prices in the economy. This has led to past misunderstandings of the position of the industry and of the degree of special assistance afforded to it.

Under these circumstances it might have seemed appropriate for the Committee, in recommending a level of assistance, to suggest that this be achieved through a 20% tariff plus an appropriate special subsidy rather than entirely in the form of subsidy.

The Committee has refrained from doing so for several reasons. A 20% tariff on the import of Commonwealth built ships would presumably require extensive negotiations with Commonwealth countries. It would also result in a rise in the prices of ships built in Canada for domestic shipping services, compared to their subsidized level now, with possible effects on shipping service rates. Moreover, replacement of the subsidy by tariff on Commonwealth built vessels would reduce effective protection vis-a-vis shipbuilders in non-Commonwealth foreign countries, which now is composed of the 25% tariff and the subsidy; in these conditions the possibility of supply by low cost, heavily subsidized, foreign builders to the Canadian market could become very real.

A matter which has been strongly advocated by the Canadian shipbuilding industry and considered by the Committee relates to the possible reservation of Canadian coastal trade to vessels built in Canada. The whole matter of Canada's policy in respect to coasting

regulations is under study by the Water Transport Committee of the Canadian Transportation Commission. Should these deliberations result in a recommendation that Canadian coastal trade be reserved for Canadian-built ships, then the traditional Canadian markets for such ships would be totally reserved to Canadian shipbuilders. This action would render the preceding recommendation regarding assistance and duty drawback inapplicable to such vessels, and to the extent that the protection would be definite rather than conditional would be preferable from a shipbuilding industry point of view. The effect would be to increase the cost of ships and of domestic shipping services from present levels.

An important aspect of the Canadian industry's ability to improve its performance relative to shipbuilding industries in other countries lies in the introduction of new facilities, machinery, equipment, operating practices, methods etc. The Committee has assessed the present technological capability of Canadian shipyards in comparison with yards of a similar nature and size in other countries and has found that some Canadian yards have introduced technical improvements to a considerable extent in recent years and are on a par with comparable foreign yards.

At the same time, the Committee sees no grounds for complacency on the part of the Canadian industry if it is to effectively compete in traditional domestic markets and in new developments that are in prospect. In addition to exerting its own energies, the industry will need to have access to government measures for upgrading and modernizing operations to the greatest extent possible.

In this connection, the Committee's assessment is that changes in production processes and methods that are particularly significant for the operations of the shipbuilding industry are not adequately provided for in existing government programmes which appear to be oriented more toward scientific research and defence export. At the same time the Committee is reluctant to suggest any special programmes for the shipbuilding industry as such, and would prefer that means be found for the industry to take advantage of existing programmes.

Accordingly the Committee recommends as follows:

Recommendation No. 4

> That the provisions of existing government industry assistance programmes be modified, and the interpretation of their regulations be such, that the shipbuilding industry will have access to provisions aiding the upgrading of performance and technology.

The Committee accepts the policy principles of increasing efficiency and of a declining subsidy level. The previous two recommendations, taken together, constitute the Committee's view that since productivity improvements by the Canadian industry must be additional to the gains that will be achieved in other countries more time must be provided for the Canadian industry to reach the eventual objective.

The Committee recognizes that calculations of levels of cost differentials and of special assistance needed can only be approximate because of variations in ship types built and of regional variations in costs and conditions. Nevertheless the Committee is of the view that its recommendations for special assistance, duty drawback on imported components, and access to government modernization programmes, are realistic, minimum requirements for a national Canadian industry to survive and develop.

It should be stressed, however, that a presumption underlying the proposals is that relative conditions in the future will not differ greatly from those that prevail now. Major new developments which would create substantial changes in competitive conditions (e.g. substantial variation in exchange levels) would require reassessment of the details of assistance provisions.

Accordingly, the Committee recommends as follows:

Recommendation No. 5

That, if there are major developments materially affecting the international competitive standing of the Canadian shipbuilding and ship repairing industry and its position relative to Canada's maritime interests, there be early joint review by government and the industry of the new factors to determine whether amendments to assistance provisions may be appropriate.

One example of the need for such future review is with regard to financial aspects of ship owning and shipbuilding. Thus income tax deferment through accelerated depreciation has been a significant factor for shipowners in Canada as a source of funds for the ordering of new vessels, but the attractiveness of this provision may be reduced if the tax credit proposals in the White Paper on Taxation are put into effect. Also, use of proceeds of disposition for replacement purposes have been significant, but such use will cease by 1974. Current high interest rates in Canada will have an effect on financing and thus the ordering of new ships, in a similar manner to their effect on other major capital investments. There is, however, an added competitive feature in the case of shipbuilding since the easier credit conditions available to shipowners placing orders in the United Kingdom could well result in loss of business for Canadian yards.

The Committee gave consideration to numerous suggestions that had been made regarding the need for and the means by which special financing arrangements might be extended for purchase of ships from Canadian yards for domestic operation. It concluded that while there is a problem, it does not appear to be of the proportion that requires a recommendation for government action in this regard at the present time. However, the Committee stresses that continued financial stringency in Canada, allied with changes in the other aspects of ship financing, could produce a considerable deterioration in the competitive position of ship-building in Canada.

Accordingly the Committee makes the following recommendation.

Recommendation No. 6

> That the industry and government jointly keep under review factors affecting the financing of ship purchases in Canada for domestic operation, and ensure that these are appropriate in the future conditions that prevail.

Thus far the Committee's recommendations have been concerned with industry operations in relation to traditional markets for the building of commercial (other than fishing) vessels and for government naval and non-naval ships, which provided a level of

operations for the industry as a whole that averaged some 50% of capacity in the latter half of the 1960's.

Detailed assessments indicate that the demand on the industry from these sources during the 1970's is likely to be much the same as during the 1960's. Despite curtailment in recent years of the capacity of the industry through closure of yards or withdrawal from shipbuilding operations, prospective supply from existing yards indicates an average level of operations that appears to be too low for realization of productivity gains to the extent required.

The Committee, while recognizing that average industry operating rates are a composite of higher rates in some yards and lower in others, gave considerable attention to ways in which demand on the industry might be expanded or industry capacity could be contracted.

New developments in the coastal and offshore waters of Canada constitute what in the Committee's view are the most significant potential for additional demand for Canadian shipbuilding yards. The Water Transport Committee of the Canadian Transportation Commission is investigating the dimensions of these possibilities as part of its review of coasting regulations. The Committee on Shipbuilding considers that all vessels and watercraft engaging in these new developments should be under Canadian flag, subject to the rights of present non-Canadian operators in their existing operations on both coasts being safeguarded by appropriate grandfather provisions.

The effect of the measures the Committee has in mind would be to establish the Canadian presence and Canadian control in all types of watercraft being used in Canadian waters to the outer edge of the continental shelf and encompassing the Arctic areas. Operation under Canadian flag would qualify such classes of vessels for the protection and special assistance measures already outlined. It seems entirely reasonable to the Committee that all forms of waterborne activity in the contiguous waters of Canada be regarded as a natural market for the Canadian shipbuilding and ship repairing industry.

Accordingly the Committee makes the following recommendation:

Recommendation No. 7

That all vessels and watercraft, including exploration and service vessels, engaging in trade or other operations in the coastal waters of Canada to the outer edge of the continental shelf and encompassing Arctic areas, be registered in Canada.

The Committee recognizes that it may be necessary to bring in, on a temporary basis, non-Canadian vessels or watercraft for particular purposes in situations where Canadian flag capability does not exist. However, the permanent importation of foreign built vessels to operate under Canadian registry is a matter for ministerial

discretion and the application of this discretion has caused dissatisfaction in the past.

Thus the Committee makes the following recommendation:

Recommendation No. 8

> That all applications received by the Minister of Transport for approval to import a vessel or other watercraft into Canada and place it on Canadian registry be published in the Canada Gazette, so that interested parties may make representations to the Minister within a specified period.

Taking advantage of the potential demands that are likely to develop in offshore and Arctic areas will require major efforts by the industry, with yards acting individually or in groups, and in some circumstances jointly with government.

The expertise of Canadian yards and of the shipbuilding industry has been particularly related to the conditions within which it has been operating. The basic capability exists to build the new vessels or watercraft required in these new developments and, to the extent that particular design or construction expertise may be lacking, this can be readily acquired.

There is need to bring together information relating to operations in offshore and Arctic areas so that ability to design and construct vessels fully appropriate to the conditions will lead to achievement of the market potential. In this respect information

from government and other sources, particularly with regard to the Arctic, could be most important for the success of the industry's efforts.

It is imperative that individual yards, the industry and government work together to obtain maximum benefit from these new developments.

Without being specific on the details of how this might be done, the Committee recommends as follows:

Recommendation No. 9

> That, in the fields of offshore exploration and Arctic development, every effort be made by industry and government to fully explore the market potential for vessels and watercraft and that the industry in particular, acting as individual yards or jointly as a group, take the necessary steps to obtain full knowledge of design and construction requirements for such craft in order to develop this market for Canadian yards.

Another possible source of new demand for the Canadian shipbuilding and ship repairing industry would be the provision of ships to the export market. This possibility has been advocated to the Committee and has been given careful consideration.

In light of the general situation of the Canadian shipbuilding industry, including relatively high labour rates and material costs, it is evident that building of ships for export would

require substantial assistance to bring Canadian ship prices into line with world levels.

Such assistance would be justified if the effect on the scale of operations of the industry were sufficient to significantly reduce unit costs and, eventually, the level of assistance needed for both domestic and export markets. The Committee has concluded, however, that this is unrealistic. The amount of assistance and the scale of operation needed to establish Canadian shipbuilding on such a new plane would be extremely large. The world market for ships is a very competitive one and a very expensive undertaking for the industries and governments which are now engaged in it.

Given, then, that an attempt by Canadian shipyards to break into the world market in a major way would be extremely costly, there remains the possibility of selective participation in certain carefully chosen segments of that market.

In this connection, the ability of Canadian yards to offer fast delivery of ships of conventional type and size appears to offer potential for export in periods of tight world supply. It is desirable therefore that promotion and financing arrangements for such business be as effective as possible. Even in respect to this situation, however, the Committee considers that ability to offer competitive prices would be a major determining factor and that assistance of the order of the level afforded to shipbuilding for the domestic market would also be necessary for supply to export markets.

Another possibility is the export of special types of ships which are within the Canadian industry's immediate range of production capabilities and experience but which, by virtue of their sophistication or qualities, would appear to provide a particular opportunity of obtaining business internationally. Such suggestions are most commonly made in respect of naval warships, oceanographic vessels, and other specialized vessels. While the Committee associates itself with this general expression of view, it is obliged to state that such export opportunities are by no means unique to Canadian shipbuilding. Technical knowledge is freely available in the shipping world and, although particular yards or countries may have some greater experience than others in certain particular fields, expertise is readily available and is easily obtained. Thus, while relatively specialized vessels may indeed offer Canadian shipbuilding a good opportunity of participating in world markets, such possibilities are not necessarily continuous or major, nor could they be achieved without an extra degree of assistance.

A further source of foreign demand may be the provision of vessels by Canada under its foreign aid programmes, these vessels being either new for particular trades in foreign countries, or oceanographic and other scientific vessels that were originally built for Canada, are due for replacement in Canadian operations, but would be entirely satisfactory in operations in other countries.

All of the foregoing indicates that export of ships by the Canadian shipbuilding industry, while possible under appropriate market and assistance conditions, will be difficult to develop. In these circumstances it is desirable that all steps be taken to make exploitation of the opportunities as effective as possible.

Accordingly, the Committee recommends as follows:

Recommendation No. 10

That the industry and government take steps to ensure a better flow of information regarding export potential and, in particular, that Canadian Trade Commissioners be fully informed of the capabilities of the Canadian industry with regard to ship types, delivery times, prices etc.

That the financial terms offered by the Export Development Corporation in support of exports of ships be equal in all respects to those offered by other countries, and that the mechanism for arranging such credits be geared to prompt approval as quick delivery will always be a major factor in Canadian yards securing an export order.

That the government consider the provision of oceanographic or other specialized vessels in Canadian aid programmes to other countries, and of other commercial vessels to the extent that these may be required by such countries.

A further means of expanding demand for the Canadian shipbuilding and ship repairing industry would be the provision of Canadian built ships to a Canadian flag deep-sea fleet. The Canadian Transportation Commission is studying the benefits and costs that may

derive from the operation of a Canadian flag fleet, assuming that vessels for the fleet were available at world market prices. Should its study record that operating benefits favour a Canadian flag fleet under these conditions, then it would be desirable to investigate in detail the cost and benefit conditions for supply of the vessels from Canadian shipyards to such a fleet. This would in effect constitute an extension of the domestic market and could be an important new source of demand on the Canadian shipbuilding industry. Accordingly recommendation is made as follows:

Recommendation No. 11

> That a careful study of the costs and benefits for supply of Canadian built ships to a Canadian flag deep-sea fleet be carried out, should the operation of such a fleet be found to be justified by the Canadian Transportation Commission.

Finally, increased volume for the shipbuilding industry may be possible through expanded manufacture of heavy industrial, non-marine products. To do this on a sizeable scale, however, and to be competitive with large, well established, heavy industrial firms, the shipbuilding industry would have to invest in special facilities that would be, to a large extent, separate from their shipbuilding operations. A few yards do operate in this manner. However, the majority of yards are not located in areas with extensive industrial

bases where there are broad markets for semi-finished and finished products. While yards will undoubtedly attempt to increase their industrial work, this is unlikely to be more than a supplement, generally, to their main activity of shipbuilding and ship repairing and would make use of common rather than special facilities.

Having discussed possibilities for increasing the level of demand and the scale of operations for the industry in Canada, it is necessary also to consider the possibility of reducing the industry's capacity, since the Committee's investigations have revealed that a considerable degree of excess capacity exists in relation to the foreseeable demand for ships. Reduction in capacity by consolidation or closure of shipyards, allied perhaps with conversion of some of them to industrial operations, could lead in any given set of demand conditions to a higher scale of operations for the remaining yards and therefore to improved efficiency and lower costs.

This would represent a continuation of what has already been occuring. The Committee considers that these changes will best be accomplished by the operation of competitive market forces rather than as part of any planned programme of reduction in capacity.

The process will not be easy for individual companies, for the employees of such companies, and possibly for the local

economies in which yards are situated since these are often the major source of industrial employment in the area. Bearing in mind the difficulties, companies should endeavour to indicate their intentions as early as possible, so that government departments can arrange to give all appropriate assistance to displaced labour through retraining and relocation programmes, and to use the provisions of the Regional Development Incentives Act to develop new activities for the employees and the facilities that exist in particular areas.

In the light of the outlook for the industry, the Committee wishes to register its conviction that there should be no further encouragement, directly or indirectly by the government, toward the opening of new yards as has occurred in recent years. In making this statement the Committee is not attempting to restrict the forces of competition within the industry; these have been active and will continue to be so. Rather the Committee is stating that it is highly inappropriate to create new capacity when over-capacity already exists.

The Committee considers it important that the process of consolidation or yard closure be watched to ensure that it does not go so far as to impair the presence of needed ship repair facilities. The Committee recognizes that provision of ship repairing services need not invariably be accompanied by shipbuilding operations; indeed there are several instances in Canada where this is so. However, the Committee considers it essential that there be

large combined shipbuilding and ship repair facilities on both coasts and in inland waters. It would be unfortunate if a point was reached where it became necessary for special assistance to be extended to maintain ship repairing services.

In light of the foregoing comments the Committee makes the following recommendation:

Recommendation No. 12

That consolidation and phasing out of individual Canadian shipbuilding and ship repairing operations be a matter for competitive market forces, with appropriate action by industry, labour unions and the government to minimize the social dislocations of such developments, and that the opening of new yards be discouraged in the interests of achieving a stronger and more concentrated Canadian shipbuilding industry.

A further comment regarding repair facilities is appropriate, in view of the giant bulk carriers which will be using Canadian coastal ports in numbers in the very near future. Increased repair capabilities will be required on the Atlantic and Pacific coasts and this will necessitate the provision of dry-docking facilities of capacities considerably greater than now exist.

Recommendation No. 13

That the government study the need for larger dry-docking facilities on both coasts and establish its policy in the near future regarding the financial and other means by which these might be provided.

Another matter of considerable importance to achievement of improved productivity and efficiency in Canadian shipyards relates to trade classification and demarcation practices. The Committee has noted in other countries movement toward a less rigid demarcation of trades, and its discussions with labour and management in Canada have brought to light recognition of the need to change.

Recognition of fewer trades with increased flexibility would contribute greatly to improved stability in employment, both in individual yards and in the industry as a whole. The Committee therefore considers it necessary that there be a complete review of the trade and craft provisions in Canadian yards.

While this matter is important for each yard and each union local, the significance is so great that the Committee considers it is best approached initially on provincial or regional levels, with subsequent more detailed discussion in accord with local situations. Accordingly the Committee recommends as follows:

Recommendation No. 14

> That the industry promote the formation of joint labour/management study groups to investigate the opportunities for reduction in demarcation and increased flexibility between trades, to accord with the technological and economic conditions of the 1970's and with full recognition of the importance of stable employment.

There are some aspects of government action or policy vis-a-vis the industry where changes are desirable. Since government orders are a substantial part of industry new construction activity and since government regulation and programmes are so significant to the industry, it is inevitable that government actions are of major importance to it. The Committee has several recommendations to make in this respect.

The first relates to the matter of government procurement. This originates in a number of government departments, is for a variety of types and sizes of vessels, and is of major significance in the industry's new construction operations. The Committee recognizes that it is difficult for government, no less than for private industry, to specify precisely in advance the nature of its requirements. Nevertheless a preliminary indication of intentions would be valuable to the industry in establishing its own longer range plans for the future. Such an indication is available to an extent now, but the fact that the Committee had to spend considerable time and effort in obtaining a reasonably comprehensive picture of future departmental intentions regarding ship procurement, illustrates that the existing mechanism is not satisfactory if the industry and individual companies in it are to be informed to a worthwhile extent regarding overall government purchasing intentions. It is desirable that this awareness relate not only to the scale of government requirements but to changing emphasis on types of vessels, design, materials and technology, so that preparations may be made to modify building practices, procedures or facilities.

Arranging to accumulate this information and to provide it through one source could, in addition, assist the government in ordering its ships and conversions to accord with the conditions prevailing in the industry at any particular time, thus helping to avoid major fluctuations in total activity in the industry. The need for the government to undertake major capital expenditures for ships could be lessened, under special circumstances, by time chartering of ships built in Canada to meet the specific needs of individual departments.

The Committee makes the following recommendation:

Recommendation No. 15

That the government as a major customer of the industry make known its long term intentions regarding construction and conversion of ships periodically, but not less than once a year, and that it afford the industry the opportunity of being aware of advanced design, research and technical projects relating to future government needs.

Government policy regarding repair, refit and conversion of its naval and non-naval vessels is also of major importance to the shipbuilding industry, particularly in respect to the functions and operations of the naval dockyards on both coasts. The Committee fully recognizes the need for a government operational capability on both coasts in support of the fleet. However there has been a tendency

for the dockyard on the West Coast in particular to increase the range of services being provided to naval vessels, including services formerly provided by the private shipbuilding industry.

The Committee appreciates that it is not possible to determine costs in government establishments in a manner comparable to that in a commercial operation, but is confident that if such a comparison were possible it would not be unfavourable to the commercial operation. The Committee is aware, too, of the incentive to increase the rate of utilization of a facility that is already in place. However, this applies equally to a commercial facility already in existence, particularly where such a facility for the building and repairing of ships is necessary to meet and serve Canada's maritime interests.

The Committee therefore recommends as follows:

Recommendation No. 16

> That the government thoroughly assess the functions of the Ship Repair divisions of naval dockyards with respect to refit, conversion and repair of its naval and non-naval vessels, and establish a maximum level of operations related to a basic civilian work force which would be appropriate to the dockyards' prime function as fleet support facilities.

A further area in which there appears to the Committee to be the need for re-examination of government policy is in the field

of fishing operations and subsidies for fishing vessels. In recent years supply of ships to the fishing industry has been important business for the shipbuilding industry; indeed it has been the mainstay for the operations of some smaller, local yards.

The circumstances under which the fishing industry has developed in Canada, including assistance measures for fishing and for the provision of vessels, are particular to that industry and differ from those applicable to other commercial markets for the shipbuilding industry. The demand for fishing vessels has been widely varied as to type and size; besides steel trawlers, there has been continuing use of wooden fishing boats and there is developing interest in vessels made of other materials, including reinforced plastic and ferro-concrete. Supply of vessels has been from steel shipyards and commercial wooden boat yards; the federal and some provincial governments have assisted the establishment of shipyards for trawlers in recent years, and this has aggravated the existing over-capacity situation. Different subsidy rates apply to wood and steel vessels and are administered by different government departments. Financial and policy provisions vary from province to province.

The fishing industry is an important component of demand for the shipbuilding industry and shipbuilders are therefore interested in the orderly development of this market for ships. In light of this, it appears desirable to the Committee that consideration of all aspects of the fishing industry in Canada, including provision

of vessels under assistance measures, be integrated for policy and operational purposes within one department at the federal level. Given the complexity of the issues and the detailed knowledge which would be required to formulate and implement sound policy throughout this whole field, it would appear logical that these responsibilities be located in the Department of Fisheries.

While the Committee does not consider it appropriate that it make specific recommendations or suggest any change in the present level of subsidy for the construction of steel and wood fishing vessels, it does consider that it is within its competence to recommend the following:

Recommendation No. 17

> That the government thoroughly study and assess its policy and practices with regard to the provision and extent of assistance for construction of fishing vessels, and for this to be relevant it should probably be carried out in conjunction with a broad review of the fishing industry in Canada.

The Committee is aware of expressions of opinion regarding certain other aspects of government practices which by their nature are significant to the industry and on occasion have caused concern and problems. These relate to matters such as tendering procedures, specifications, contractual conditions, etc. and unquestionably it is desirable that arrangements for such

matters be straightforward and mutually acceptable. A matter of considerable concern relates to the contractual conditions between government and shipbuilders, under which there is no right of appeal nor flexibility in negotiation of governing provisions. In contractual matters government departments in effect are functioning as purchaser, contractor, administrator and sole judge. Accordingly the Committee recommends as follows:

Recommendation No. 18

> That the form of government contracts with the shipbuilding industry be examined with a view to bringing governmental contractual conditions more into line with commercial practice.

A further matter relates to inspection or survey of ships under construction, repair or conversion by both government and classification societies, resulting in duplication of effort and cost. Governments in most other countries authorize recognized classification societies to undertake such inspections on their behalf. This results in a single survey authority in each yard in respect to classed ships and in resulting economies to government and industry. The Committee therefore makes the following recommendation:

Recommendation No. 19

That, in the interests of economy and efficiency, the government authorize recognized classification societies to carry out inspections on its behalf in respect of the hull, machinery, safety equipment survey and tonnage measurement on all new construction, conversion or repair of ships in Canada.

The importance of government to the Canadian shipbuilding and ship repairing industry as a source of business, and the requirement that government policies be adopted for that industry within overall policies relating to Canadian maritime interests, combine to create a situation of close and continuing association between the industry and government and between individual companies in the industry and individual government departments. Under these circumstances it is imperative, in the Committee's view, that the channels of communication, both ways, between the industry and government be open, clear and harmonious.

The Committee has considered recommending various formal ways in which such close communication and a good working arrangement could be fostered, bearing in mind the fact that the shipbuilding industry and the shipping industry respond to two different government departments. The Committee concluded that establishment of some form of industry advisory committee or

shipbuilding industry board would serve no useful purpose, since existing channels and arrangements are adequate (with minor adjustment) if they are properly used. Moreover the Committee concluded that mere establishment of a new mechanism would not accomplish the result desired unless the underlying attitudes were such as to make it work.

This being the prerequisite, the Committee has restricted its recommendation to the following, with the hope that it is interpreted broadly:

Recommendation No. 20

> That those in industry and government, individually and collectively, work continuously toward fostering co-operation, communication, and effective operating relationships.

The Committee has called for statements of maritime policy, for further study in certain respects, and for actions to be taken on completion of studies now underway. It wishes to emphasize that this does not imply a need for delay before its recommendations are implemented.

The Committee considers that these recommendations are sound, necessary and urgent. The shipbuilding and ship repairing industry in Canada has good potential in the future provided action is taken now to do what needs to be done.

Accordingly the Committee's final recommendation is:

Recommendation No. 21

That the government express its intentions regarding these recommendations at the earliest possible date, and that government departments concerned, the shipbuilding and ship repairing industry as a whole, and individual shipyards, move individually and jointly to accept and implement the recommendations with all speed thereafter.

PART II

CANADA

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CANADA

CHAPTER I

DEMAND FOR SHIPPING SERVICES

Commercial Cargoes

This chapter examines Canada's waterborne trade patterns and volumes for both coastal and international trades, and makes forecasts of future trade volumes to 1980 which are used as a basis for establishing future shipping requirements. The forecasts included in this section consists of summarizations and consolidations of the more detailed forecasts included in the sections covering the Atlantic, Great Lakes and St. Lawrence, and Pacific Regions. These do not purport to be detailed analyses, but rather broad indications of waterborne trade volume and its main components for the purpose of establishing future ship needs, with some indication of the ship types.

For the purpose of this summary, Canadian waterborne trade has been divided into the following movements:

Coastal: Trade between Canadian ports on the Atlantic and Pacific coasts;

Inland: Trade using the Great Lakes or St. Lawrence Seaway system, including "coastal" trade between Canadian ports and "international" trade between Canadian and U.S. ports, but excluding off-shore cargoes;

Canada-U.S. Continental: Trade between Canada and the Continental U.S. on the Pacific and Atlantic coasts;

Off-shore: International trade between Canadian and foreign ports, except with the Continental U.S.

Table C-1 summarizes the Canadian coastal and international waterborne trade for the period 1953-1967 by the main trades as defined above and in the footnotes to the table. (Statistics

TABLE C-2

CANADA

EXPORTS BY MODE OF TRANSPORTATION
1963 - 1967

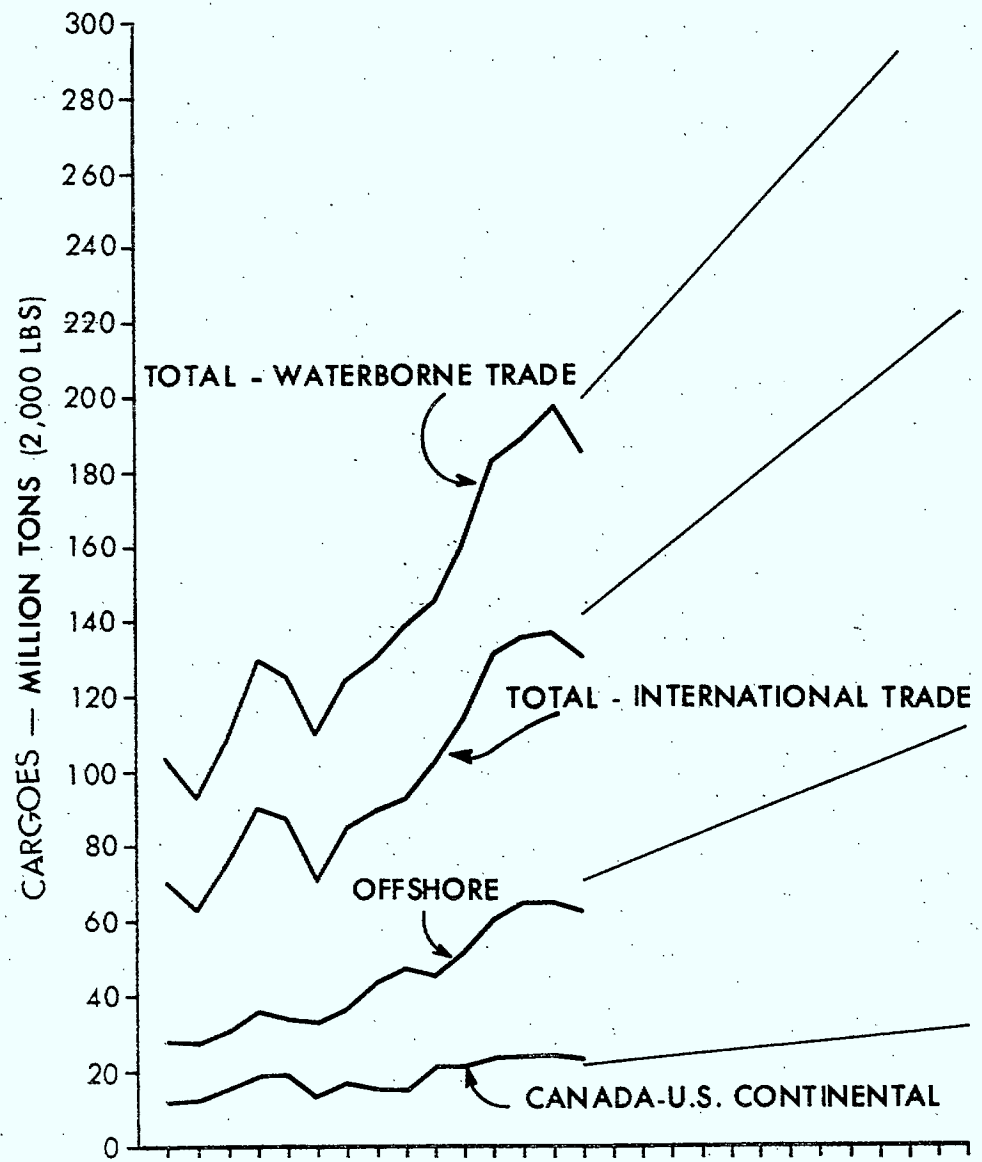
	$ millions					%				
	1963 (9 mos.)	1964	1965	1966	1967	1963 (9 mo.)	1964	1965	1966	1967
To U.S.A.										
Water	642	838	853	950	889	22.0	18.9	17.6	15.2	12.6
Road	592	1,076	1,313	2,075	2,402	20.2	24.3	27.1	33.3	33.9
Rail	1,368	1,894	2,069	2,554	3,080	46.8	42.8	42.8	41.0	43.5
Air	56	184	151	152	124	1.9	4.1	3.1	2.4	1.8
Pipeline	254	407	415)	504	584	8.7	9.1	8.6)	8.1	8.2
Other	13	38	39)			0.4	0.8	0.8)		
Total	2,925	4,437	4,840	6,235	7,079	100.0	100.0	100.0	100.0	100.0
To West Europe										
Water	1,259	1,838	1,911	1,885	1,942	94.1	92.5	93.7	91.4	93.1
Road) Via U.S.A.	15	32	25	32	30	1.1	1.6	1.2	1.6	1.4
Rail)	8	13	20	27	12	0.6	0.7	1.0	1.3	0.6
Air	54	99	80	113	101	4.0	5.0	3.9	5.5	4.8
Other Via U.S.A.	2	3	2	4	2	0.2	0.2	0.2	0.2	0.1
Total	1,338	1,986	2,039	2,061	2,087	100.0	100.0	100.0	100.0	100.0
All Exports										
Water	2,862	4,324	4,189	4,565	4,493	53.5	52.0	49.1	44.2	40.4
Road	654	1,190	1,422	2,225	2,545	12.2	14.3	16.7	21.5	22.9
Rail	1,445	2,011	2,191	2,724	3,218	27.0	24.2	25.8	26.4	29.0
Air	124	325	216	298	265	2.3	3.9	3.1	2.9	2.4
Pipeline	254	407	415)	514	591	4.7	4.9	4.9)	5.0	5.3
Other	18	47	47)			3.3	5.7	5.5)		
Total	5,357	8,304	8,525	10,325	11,112	100.0	100.0	100.0	100.0	100.0

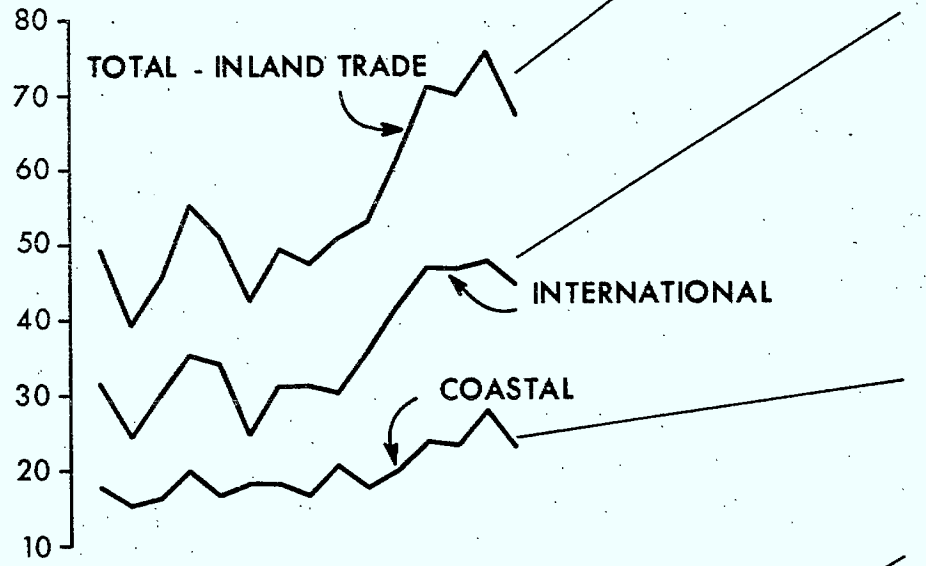
CHART C-1

CANADA

WATERBORNE TRADE

1953 – 1967 WITH FORECASTS TO 1980





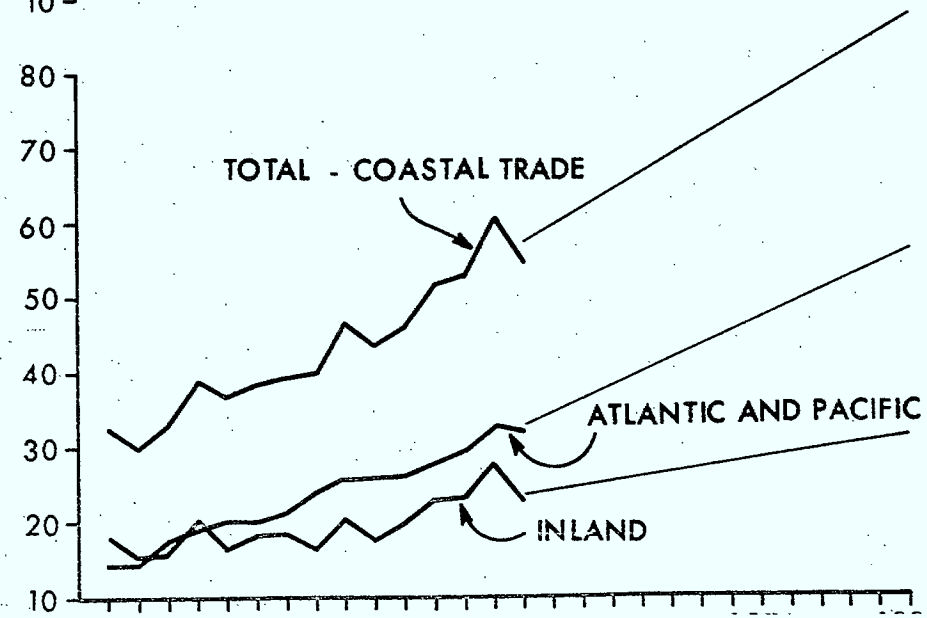


TABLE C-1

SUMMARY OF CANADIAN WATERBORNE TRADE
COASTAL, INLAND & INTERNATIONAL

1953 - 1967
(million tons)

Year	Coastal Trade			Inland Trade						
	Atlantic & Pacific (1)	Inland (2)	Total	Coastal (2)	International (3)	Total	Canada-U.S. Continental (4)	Offshore	Total International Trade	Total Waterborne Trade
1967	32.1	22.6	54.7	22.6	44.5	67.1	23.0	62.7	130.2	184.9
1966	32.9	27.8	60.7	27.8	47.6	75.4	24.1	65.2	136.9	197.6
1965	29.8	23.3	53.1	23.3	46.9	70.0	23.9	64.9	135.7	188.8
1964	28.0	23.8	51.8	23.8	47.1	70.9	23.7	60.2	131.0	182.8
1963	26.1	19.9	46.0	19.9	41.9	61.8	20.8	51.9	114.6	160.6
1962	26.1	17.5	43.6	17.5	35.6	53.1	20.8	45.8	102.2	145.8
1961	25.9	20.5	46.4	20.5	30.6	51.1	14.7	47.4	92.7	139.1
1960	24.1	16.4	40.5	16.4	31.3	47.7	14.8	43.5	89.6	130.1
1959	21.3	18.3	39.6	18.3	31.1	49.4	16.9	36.7	84.9	124.5
1958	20.1	18.2	38.3	18.2	24.6	42.8	13.7	33.0	71.3	109.6
1957	20.3	16.6	36.9	16.6	34.4	51.0	19.1	34.4	87.9	124.8
1956	18.9	20.1	39.0	20.1	35.5	55.6	18.7	35.9	90.1	129.1
1955	17.3	15.6	32.9	15.6	30.1	45.7	15.1	30.3	75.5	108.4
1954	14.6	15.3	29.9	15.3	24.2	39.5	11.8	26.9	62.9	92.8
1953	14.5	18.0	32.5	18.0	31.6	49.6	11.3	27.9	70.8	103.3

(1) Cargoes between Canadian ports within each Region, with the Atlantic Region including the St. Lawrence River, Montreal and below

(2) Cargoes between Canadian ports on the Great Lakes and cargoes between the Atlantic Region and Canadian ports on the Great Lakes

(3) Cargoes between Canadian and U.S. ports on the Great Lakes and between Canadian ports in the Atlantic Region and U.S. ports on the Great Lakes

(4) Cargoes between Canadian and U.S. ports on the Atlantic and Pacific coasts.

are not yet available for the years since 1967 in the detail necessary for their inclusion). Chart C-1 illustrates the trends for each of the trades in Table C-1 and shows the forecasts to 1980. In 1966, off-shore trade constituted 33.3% of total waterborne trade having recorded the largest growth (130%) since 1953. (1966 is used for comparative purposes because 1967 volume was adversely affected by the inland seamen's strike). Trade in and around the North American continent therefore accounted for 2/3 of the Canadian waterborne trade tonnage in 1966, amounting to 132.1 million tons. Of this, 60.7 million tons (30.6% of total trade) was coastal, and 71.4 million tons (36.3% of total trade) was with the U.S. including both ocean-going and inland traffic. Canadian coastal trade has grown 87% between 1953 and 1966, and the Canada-U.S. trade somewhat less, 67%. In 1966, 75.5 million tons (37.1% of all waterborne trade) was inland traffic (both coastal and international) in which Canadian flag vessels had a major participation, but which had a growth of only 52% since 1953.

Table C-2 shows the significance of waterborne carriage in Canada's export trade during 1963-67. The value of exports carried by water increased only slightly in the period, and the position of waterborne movement thus declined from 53.5% of the value of all exports in 1963 to 40.4% in 1967. Almost all of Canada's off-shore exports continue to be carried by water, but the proportion going to the U.S. by water declined as road transportation increased in relative importance. Greatly expanded trade in autos and parts, shipped mainly by road and rail, was a major factor during the period, but even apart from these

products there was a fall in the share of waterborne transportation from 19% to 16%, although the absolute value of products shipped by water to the U.S. increased to some extent. Similar data are not available for imports, and in interpreting the export information it should be noted that waterborne trade accounts for a substantially greater portion of export tonnage than of export values because it is made up largely of relatively low valued bulk cargoes.

The sections following review briefly waterborne trade by its major components for each of the major trades including coastal (except inland), inland (both coastal and international), U.S.-Canada Continental, and off-shore. As indicated previously, the forecasts in this section consist of a consolidation and summarization of forecasts contained in the Regional sections. In the Regional sections the trade in each region was divided into its main cargo movements (coastal, U.S. and off-shore trades). Each of the movements was further divided into main components, mainly by commodity groups. Each of these components was forecast by projecting the 1958-1967 trend by computer analysis, with this projection modified in accordance with any developments indicated by a more general assessment. The forecasts for the components were then totalled to provide forecasts for each trade and the combination of these gave the forecast for the region.

Coastal - Atlantic and Pacific

The coastal trade includes all cargo movement between Canadian ports within the regions. The Atlantic Region includes the Atlantic coast and lower St. Lawrence area up to and including Montreal,

TABLE C-3

CANADA

SUMMARY OF ATLANTIC & PACIFIC COASTAL TRADE
1958-1967 and FORECASTS FOR 1970, 1975, & 1980
(million tons)

	1958	1961	1964	1967	Forecast 1970	Forecast 1975	Forecast 1980
Pacific Region (1)							
Raw wood	3.4	6.7	9.4	13.2	17.5	23.5	28.5
Pulp, paper & lumber	0.4	0.6	1.0	1.3	1.6	2.2	2.7
Petroleum	0.6	1.0	1.2	1.4	1.7	2.1	2.6
Non-metallic minerals	1.0	1.7	2.1	2.9	3.3	4.3	5.2
Other	1.5	1.7	1.3	1.4	1.5	1.5	1.5
Total Pacific	6.9	11.7	15.0	20.2	25.6	33.6	40.7
Atlantic Region (2)							
Petroleum	3.3	5.0	5.6	5.8	6.2	6.8	7.3
Ores & Minerals	3.1	1.6	1.6	2.8	3.0	3.7	4.5
Forest Products	2.8	3.3	2.3	1.8	1.7	1.7	1.7
Coal	1.9	1.8	0.6	0.3	0.3	0.3	0.3
Other	2.1	2.5	2.9	1.2	1.6	1.6	1.6
Total Atlantic	13.2	14.2	13.0	11.9	12.8	14.1	15.4
Total Coasting	20.1	25.9	28.0	32.1	38.4	47.7	56.1

(1) Pacific Region includes the Pacific Coast of Canada.

in accordance with the definition used by D.B.S. in compiling statistics.

The coastal trade in both the Pacific and Atlantic Regions is shown on Table C-3 for the years 1958, 1961, 1964 and 1967, together with the forecasts for 1970, 1975 and 1980.

While total coastal trade has increased from 20.1 million tons in 1958 to 32.1 million tons in 1967, the growth has occurred entirely on the Pacific coast which has offset a decline in the Atlantic area.

Pacific Region: The movement of wood, including logs, pulplogs and chips by barge constitutes the major portion of the Pacific coastal trade. The growth since 1958 has resulted from major changes in the structure of the British Columbia forest industry and from cost advantages provided by increasingly specialized barges. The growth of these wood cargoes is projected to continue at the high growth rate established since 1960, although this may make the forecast somewhat optimistic for 1980.

The growth in other commodity movements including pulp, paper and lumber, petroleum (refined), non-metallic minerals (mainly limestone) and general cargoes has been steady and reflects the area's economic development. The forecast calls for a doubling of the Pacific region coasting trade between 1967 and 1980, from 20.2 to 40.7 million tons.

Atlantic Region: The declining commodities in Atlantic area movement have been forest products, coal and general cargoes. Forest products (consisting very largely of pulpwood) have been affected by new pulp mills locating closer to their source of wood but the decline is forecast to have ended and a levelling off and possibly growth of shipments is expected. Coal shipments have declined due to a loss of markets to petroleum, but are now considered to be at their minimum levels. Petroleum, consisting mainly of regional distribution of refined products, has grown as it took over coal's markets but future growth will probably be slower depending largely on normal economic development. Ores and minerals, consisting mainly of titanium and gypsum, have shown growth since 1964 and this is expected to continue. Other commodities and general cargoes fluctuated due to the supply requirements for major mining developments and may continue to do so as a result of Arctic mining developments in the 1970's.

TABLE C-4

CANADA

SUMMARY OF INLAND COASTAL TRADE 1959-1966 AND FORECASTS FOR 1970, 1975 and 1980
(million tons cargo)

	1959	1962	1964	1966	Forecast 1970	1975	1980
Coastal							
Lakes: (1)							
Iron Ore	0.7	0.5	0.7	0.7	3.0	3.7	4.5
Grain	5.5	3.2	3.9	3.6	3.3	3.3	3.3
Petroleum	2.3	2.5	2.6	3.0	3.0	3.4	3.8
Non-metallic Minerals	1.4	2.3	2.3	1.9	1.9	1.8	1.7
Other	1.2	1.4	2.0	1.6	1.5	1.6	1.7
Total	11.1	9.9	11.5	10.8	12.7	13.8	15.0
Seaway: (2)							
Grain	3.5	4.3	8.9	10.5	6.4	6.4	6.4
Iron Ore	1.2	0.1	0.1	2.0	3.2	4.4	5.5
Petroleum	1.0	0.8	1.2	1.6	1.8	2.3	2.8
Coal	0.5	0.7	0.4	0.8	-	-	-
Other	1.0	1.7	1.7	2.1	1.8	1.8	1.8
Total	7.2	7.6	12.3	17.0	13.2	14.9	16.5
Total Coastal	18.3	17.5	23.8	27.8	25.9	28.7	31.5

(1) Cargoes between Canadian Great Lakes ports

(2) Cargoes between Canadian ports on the Great Lakes and the Atlantic Region (including the Lower St. Lawrence, Montreal and below)

Total coastal trade is forecast to increase sharply during the 1970's through a combination of rapid growth in the Pacific and slow growth in the Atlantic. However, one commodity group, sawlogs, pulplogs and chips on the Pacific coast, accounts for more than 60% of the total forecast growth of 24.0 million tons between 1967 and 1980 and any adverse developments in this area could sharply reduce the forecast of coastal trade.

Inland Trade (Coastal and International)

Inland trade is defined as cargo movement in the Great Lakes, St. Lawrence Seaway and Lower St. Lawrence river area as far as Anticosti Island. Table C-4 opposite and C-5 following, show the inland coastal and international trades respectively from the completion of the seaway in 1959 to 1966. Trade for 1967 is not included as shipping was interrupted by a lengthy seamen's strike and the cargo totals for that year are not considered representative of the longer term trend. The tables also show the projections to 1980.

The growth in Seaway trade during the 1959-1966 period covers the initial development phase of new traffic made possible by the completion of the St. Lawrence Seaway, particularly for iron ore. The traffic growth rate has therefore probably been much greater than can be expected in future years. The forecasts take this factor into consideration. The sections following comment on the main components of the inland trade and the forecasts.

Coastal:

Table C-4 shows the lakes trade between Canadian Great Lakes ports and Seaway trade (between Canadian ports on the Great

Lakes and ports on the Lower St. Lawrence and Atlantic area, Montreal and below).

Lakes: The lakes trade tonnages have remained virtually unchanged between 1959 and 1966 but showed year-to-year fluctuations. Petroleum consisting of regional distribution of refined products showed a steady increase due to regional economic growth and this is expected to continue. Grain shipments have fluctuated mainly due to variations in foreign demand. While substantial year-to-year fluctuations will continue to be experienced, there are indications of some levelling off in lakes grain movement at the 3.3 million tons per annum level forecast for the 1970's. Iron ore which has been steady to 1966 is expected to show a substantial increase by 1970 due to the availability of additional production in the Lake Superior area. Further moderate increases can be expected through the 1970's from the development of a number of known iron ore bodies in the area. Non-metallic minerals (mainly limestone and salt) and other cargoes have shown a slowly declining trend through the 1960's, largely because of competition from rail transportation, and this slow decline is forecast to continue.

The forecast calls for a resumption in the growth of lake coastal cargo tonnage through the 1970's to 15.0 million tons per annum by 1980 after a long period of stagnation through the 1955-1967 period at the 10-11 million ton per annum level. This growth will be mainly concentrated in iron ore movement which is reasonably assured. However, the forecast could be conservative if the new 1000' upper-lakes ore carriers coming into service reduce the cost of transporting ore in the upper lakes and thereby accelerate the development of Canadian Lake Superior iron ore resources.

Seaway: Total coastal seaway shipments increased from 7.2 million tons in 1959 to 17.0 million tons in 1966. The main factor in this growth was grain movement from the Lakehead to Gulf of St. Lawrence elevators. The 7.0 million ton per annum growth in grain was the result of both the increasing availability of cheap bulk carrying capacity as the Canadian Seaway fleet was built-up in the early 1960's and strong foreign markets. While some recovery of these markets from the present low levels is expected, consistent shipments at the peak 1966 volume of 10.5 million tons per annum is not foreseen. The forecast calls for an average annual volume of 6.4 million tons through the 1970's but with the expectation of sharp year-to-year fluctuations. The possibility exists that by the late 1970's unit-trains may be competitive with ships in carrying grain from the prairies to tide-water ports. Iron ore shipments from the Gulf of St. Lawrence to Ontario did not commence in any volume until 1965. The forecast growth of iron ore shipments from 2.0 million tons in 1966 to 5.5 million tons in 1980 is based on the very substantial increase in Ontario steel production, which is expected to almost double during the 1970's. The Lower St. Lawrence area will be an important source of additional ore requirements. Petroleum shipments up the Seaway

TABLE C-5

SUMMARY OF INLAND INTERNATIONAL TRADE 1959-1966 & FORECASTS FOR 1970, 1975 & 1980

(million tons cargo - loaded & unloaded)

	1959	1962	1964	1966	Forecast 1970	Forecast 1975	Forecast 1980
International:							
Lakes: (1)							
Iron Ore	6.8	9.4	10.6	8.5	7.5	7.5	7.5
Coal	10.3	10.2	13.1	14.6	20.7	27.3	34.5
Non-Metallic Minerals	3.2	3.6	3.8	3.8	3.9	4.4	4.8
Forest Products	0.4	0.5	0.4	0.5	0.4	0.4	0.4
Grain	0.3	0.5	0.3	0.3	0.4	0.4	0.4
Other	2.8	2.1	2.0	2.0	1.8	1.6	1.3
Total	23.8	26.3	30.2	29.7	34.7	41.6	48.9
Seaway: (2)							
Iron Ore	5.1	5.7	12.3	13.6	15.7	19.0	22.0
Grain	0.6	1.8	2.2	2.3	2.8	3.7	5.5
Coal and Coke	0.7	0.7	0.7	0.6	.5	.5	.5
Other	0.9	1.1	1.7	1.5	2.2	2.8	3.4
Total	7.3	9.3	16.9	18.0	21.2	26.0	31.4
Total: International	31.1	35.6	47.1	47.7	55.9	67.6	80.3
Total: Coastal (from Table C-4)	18.3	17.5	23.8	27.8	25.9	28.7	31.5
Total: Inland Trade	49.4	53.1	70.9	75.5	81.8	96.3	111.8

(1) Cargo movement between Canadian and U.S. Great Lakes ports

(2) Cargo movement between U.S. Great Lakes ports and Canadian ports in the Atlantic and Lower

consists of refined products for which insufficient refinery capacity exists in the Region. A continued slow growth of petroleum is expected consistent with the increased demand in Ontario, but any major increase is unlikely in view of the National Oil Policy which is assumed not to change during the 1970's. Coal shipments from Nova Scotia to Ontario will virtually end by 1970 as the main buyer, Ontario Hydro, is turning to other sources. Shipments of other cargoes are forecast to level off at the 1967 volume of 1.7 - 1.8 million tons. While these have shown a growth trend since 1959, it is expected that the transportation of containerized general cargo by unit-trains will have sufficient impact to limit the growth of general cargo volume.

The forecast indicates that total Seaway coastal trade will show virtually no change at the 16.5 - 17.0 million ton level between 1966 and 1980. Grain movement is expected to be of less importance in seaway trade as 1966 was an abnormally heavy year for grain movement, which should level off at lower levels during the 1970's. Iron ore and petroleum should contribute to the overall growth of tonnage to offset termination of coal shipments and a levelling off of general cargo volume.

International

Table C-5 shows the international Lake and Seaway trade. The Lakes trade consists of cargo movement between Canadian and U.S. Great Lakes ports. The Seaway trade consists of cargo movements between U.S. Lakes ports and the Atlantic and Lower St. Lawrence area, Montreal and below.

Lakes: Total Canada-U.S. lakes trade showed a 25% increase from 23.8 to 29.7 million tons between 1959 and 1966. Coal, moving entirely from U.S. ports to Ontario, was the major component accounting for almost one-half the 1966 cargoes. Coal tonnages are expected to increase sharply during the 1970's due to the increased requirements of Ontario Hydro and the Ontario steel industry. The projections are based on forecasts of Hydro and steel requirements but do not provide for any increase in coal consumption by other industrial users from the 1967 level. The total may therefore be conservative. Iron ore traffic consisted in 1966 of 4.1 million tons exported by Canada and 4.4 million tons imported from the U.S. The exports are forecast to level off during the 1970's at 4.5 million tons per annum due mainly to Ontario Government ore export restrictions. Iron ore imports are forecast at only 3.0 million tons per annum (the 1967 and 1968 levels), with the Ontario steel industry turning largely to domestic sources. This could be upset by transportation cost reductions for U.S. Lake Superior ores made possible by the advent of the 1000' upper-lakers in the early 1970's. Non-metallic mineral tonnage consists of a relatively well balanced, largely local, export and import of limestone, crushed stone, gravel, etc. The projection to 1980 indicates a continuation of

a well defined upward trend in shipments between 1959 and 1967. Forest products (pulp and paper) exports and grain (feed grain) imports have shown a steady pattern since 1959, with some year-to-year fluctuation. No significant change is foreseen. General cargo volume, consisting of a balance of exports and imports made up of a wide range of manufactured and semi-manufactured products, has been declining steadily since 1959, probably due to competition from rail and truck transportation. This slow decline is forecast to continue.

The substantial growth forecast for the Canada-U.S. lakes trade from 29.7 million tons in 1966 to 48.9 million tons in 1980 is largely a result of increased coal imports. With the exception of slow growth in non-metallic minerals, only minor changes are expected in the movement of other commodities.

Seaway: Total Canada-U.S. Seaway traffic increased sharply from 7.3 million tons in 1959 to 18.0 million tons in 1966. The increase was mainly (80%) in iron ore movement from the Gulf of St. Lawrence to U.S. Lake ports. Up to 1964 the increase resulted from new capacity at the mines. Since 1965, U.S. consumption of Quebec-Labrador ore has levelled off and the continuing increase in seaway shipments largely represents diversion to the Seaway route of ore previously delivered via the Atlantic coast. The increase in Seaway iron ore shipments forecast for the 1970's is based on increased U.S. requirements and some further diversion of Atlantic coast deliveries. The forecast growth, while moderate, could be reduced from the forecast levels by any acceleration in the development of U.S. Lake Superior ores due to cost advantages created by the new 1000' "upper-lakers". The grain movement consists of wheat and feed grains particularly corn, moved from the U.S. Mid-West to Gulf of St. Lawrence for transshipment to Europe. The increase forecast for the 1970's is largely in feed grains for which a strong European market is expected. Coal and coke traffic to the Atlantic region has been steady and is forecast to remain at 1967 levels. The general cargo traffic is a balanced two way trade consisting mainly of up-bound pulp and paper, and down-bound bulk chemicals and industrial materials. As these cargoes are not readily containerizable, the forecast is for a continuation of the upward trend in shipments displayed since 1959.

The forecast for total inland international seaway shipments is for a moderate rate of increase from 18.0 million to 31.4 million tons per annum in the 1966-1980 period. The increase will be mainly in iron ore although grain and general cargoes are also expected to make moderate gains.

The forecasts for Seaway traffic, both coastal and international are based on the assumption that there will not be any increase in the size of the Seaway locks, and that if there is any toll increase, it will be moderate so as not to give alternative shipping routes or transportation modes a major advantage.

TABLE C-6

CANADA

SUMMARY OF U.S.-CANADA CONTINENTAL TRADE (EXCLUDING INLAND) 1968-1967 AND FORECASTS FOR 1970, 1975 and 1980

(million tons cargo - loaded and unloaded)

	1958	1961	1964	1967	Forecast 1970	1975	1980
Pacific Region: (1)							
Forest Products	2.2	3.2	2.9	3.8	4.3	5.1	5.9
Non-Metallic Minerals	-	0.3	0.7	1.9	2.4	3.4	4.4
Petroleum	0.4	0.4	0.5	0.8	1.0	1.3	1.6
Other	1.1	0.9	1.5	1.5	1.3	1.4	1.6
Total: Pacific	3.7	4.8	5.6	8.0	9.0	11.2	13.5
Atlantic Region: (2)							
Ores & Concentrates	4.9	4.2	10.7	7.8	6.0	6.0	6.0
Non-Metallic Minerals	2.7	3.9	5.0	3.9	5.0	5.4	5.9
Forest Products	0.9	0.9	1.0	1.0	1.2	1.3	1.4
Coal	-	0.2	0.1	0.5	0.5	0.5	0.5
Other	1.5	0.7	1.3	1.8	2.8	3.5	4.1
Total: Atlantic	10.0	9.9	18.1	15.0	15.5	16.7	17.9
Total: U.S.-Canada Coastal	13.7	14.7	23.7	23.0	24.5	27.9	31.4

(1) Mainly cargoes up and down the Canada-U.S. Pacific coast, but also including some shipments to the U.S. Atlantic Coast

(2) Cargoes between the Atlantic and Lower St. Lawrence area (Montreal and below)

The forecasts for total inland trade including both coastal and international seaway and lakes cargoes are shown on the bottom of Table C-5. The forecast increase, from 75.5 million tons in 1966 to 111.8 million tons in 1980, totals a 48% increase over 1966, or an average of about 3.5% per annum (not compounded).

Canada-U.S. Continental Trade

Table C-6 opposite summarizes the main components of the Continental trade in the Atlantic and Pacific Regions. This trade consists of cargo movements up and down the Atlantic and Pacific Coasts. There is relatively little trade between the Atlantic and Pacific Regions, with the exception of lumber moved from the Pacific Region to the U.S. Atlantic Seaboard (1.5 million tons in 1967).

Pacific Region: The Pacific Region Canada-U.S. trade has shown strong growth, more than doubling from 3.7 million tons in 1958 to 8.0 million tons in 1967. The main areas of growth have been forest products and non-metallic minerals, mostly limestone. Imports of refined petroleum products to meet shortages in domestic supplies for certain products have also grown slowly. General cargo growth has been slow with wide fluctuations from year-to-year. The total cargo forecasts of 9.0, 11.2 and 13.5 million tons per annum in 1970, 1975 and 1980 respectively are dependent on continued growth of forest products and minerals. There is some doubt as to the availability of coastal timber resources required to meet such continued growth, so that the total forecast for the late 1970's may be optimistic.

Atlantic Region: The overall growth in this area from 10.0 million tons in 1958 to 15.0 million tons in 1967, has been provided almost entirely by mine products. Iron ore shipments from the Gulf of St. Lawrence to the U.S. Atlantic Seaboard increased sharply in the early 1960's with the expansion of the Quebec-Labrador iron mines. However, these shipments have declined since 1964, mainly because of competition from the Seaway route. The decline is forecast to level off at 6.0 million tons per annum during the 1970's particularly if increases in Seaway tolls narrow the seaway route's cost advantage. The non-metallic mineral trade consists mainly of gypsum exports. While year-to-year fluctuations in shipments have occurred

TABLE C-7

CANADA

SUMMARY OF OFFSHORE TRADE (1)

1958-1967 & FORECASTS FOR 1970, 1975 & 1980

(million tons cargo - loaded & unloaded)

	1958	1961	1964	1967	Forecast 1970	Forecast 1975	Forecast 1980
Pacific Region							
Grain	4.0	4.9	5.9	4.8	6.1	7.1	8.0
Ores & minerals	1.0	1.7	2.7	3.3	4.0	5.0	6.0
Forest products	1.3	2.5	3.9	4.6	5.3	6.9	8.5
Coal	-	0.7	0.9	1.1	7.0	11.5	12.0
Fertilizer	0.1	0.1	0.4	1.1	1.2	1.8	2.3
Other	1.6	1.6	2.6	3.1	3.7	5.1	6.4
Total - Pacific	8.0	11.5	16.4	18.0	27.3	37.4	43.2
Atlantic Region							
Grain	5.0	6.9	10.9	6.7	9.2	10.1	11.9
Ores & concentrates	6.5	8.0	8.1	11.4	13.0	15.6	18.3
Petroleum	5.9	10.4	11.7	14.6	15.8	17.8	19.8
Forest products	1.2	1.9	2.6	2.2	3.2	3.9	4.7
Other	5.6	6.7	8.0	6.4	8.2	8.8	9.4
Total - Atlantic	24.4	33.9	41.3	41.3	49.4	56.2	64.1
Great Lakes Region							
Grain	-	0.5	0.4	0.8	0.5	0.5	0.5
Petroleum	0.1	0.2	0.3	0.5	0.5	0.6	0.7
Other	0.5	1.3	1.8	2.1	2.7	2.7	2.7
Total - Great Lakes Region	0.6	2.0	2.5	3.4	3.7	3.8	3.9
TOTAL Off-Shore	33.0	47.4	60.2	62.7	80.4	97.4	111.2

(1) Cargo movement between Canadian ports and all foreign ports except those in the Continental U.S.

due to variations in building activity, the longer term prospects are highly favourable. Forest product exports, mainly pulp and paper are forecast to grow in accordance with the demand of the U.S. Atlantic Seaboard market. The new productive capacity being planned for the Atlantic region should be sufficient to meet the growth projection. The coal imports are mainly metallurgical coal, and have some potential for growth above the 0.5 million tons per annum level if there is any substantial growth in the primary steel capacity in the region. The general cargo consists of a wide range of food and raw materials, including bulk imports of phosphates. Shipments have varied sharply from year-to-year and the projection indicates only a slow growth trend.

The growth in total Canada-U.S. Continental traffic is expected to be relatively slow, the forecast calling for total growth of only 32% between 1967 and 1980. Most of this traffic is well established, and barring any major unforeseen development, the growth of tonnage will depend on normal economic growth.

Off-Shore Trade

Table C-7 summarizes by its major components the total Canadian off-shore trade between Canadian ports and foreign ports except those in the Continental U.S. The total off-shore trade has shown rapid growth, almost doubling from 33.0 million tons to 62.7 million tons between 1958 and 1967.

Pacific Region: The Pacific Region has shown rapid trade growth from 8.0 million tons in 1958 to 18.0 million tons in 1967, and a continuation of this trend is expected to 1980. The main factor in this growth will be the export of metallurgical coal to Japan, in which annual volume of 11 million tons is assured by 1973 by contracts on hand. The forecast that shipments will grow by only 1 million tons per annum between 1973 and 1980 is very conservative in view of the prospects for increased Japanese demands. The ores and minerals trade consists of imports of bauxite, salt and gypsum in relatively small quantities, and the export of iron ore and base metal concentrates. The forecast trade tonnages may be optimistic in the face of a highly competitive iron ore supply situation in the Pacific Rim area. Also a domestic base metal smelter will probably be in operation after

1975, and will reduce concentrate exports. Grain shipments are also forecast to grow slowly since export prospects to the heavily populated Asian markets are generally much more favourable than Atlantic exports to Europe. Despite optimism as to Asian grain self-sufficiency, population pressures and periodic weather problems should create a growing grain market for some time to come. Forest products are forecast to grow as a continuation of the 1958-1967 trend. In the late 1970's limitations in the availability of coastal wood resources may cause a levelling of growth from that area but this may be offset by expanding interior production. Fertilizer exports to 1967 do not reflect the full impact of the Saskatchewan potash production which, despite present problems, is expected to contribute to future tonnage. General cargo trade tends to fluctuate from year-to-year. The main threat is containerization and shipment via Seattle which is at present better equipped than Port of Vancouver.

As indicated, there are major uncertainties in the forecast of the Pacific Region off-shore trade. However, in total, conservative forecasts for coal and fertilizer probably more than offset any optimism in minerals, forest products and general cargo.

Atlantic Region: Total Atlantic Region off-shore trade has increased 70% from 24.4 million tons in 1958 to 41.3 million tons in 1967. The forecast calls for a continuing but slower rate of growth to a total of 64.1 million tons by 1980. The main factor in this projected growth is iron ore, as the expansion of shipments from Quebec-Labrador and probable new developments in the Arctic are expected to add 7 million tons to shipments between 1967 and 1980. This output is expected to go to Europe. Grain shipments (including both Canadian and U.S. grains loaded at Atlantic and Gulf of St. Lawrence ports) should show moderate growth despite the current depressed market which makes the 1970 trend forecast high. The petroleum trade consists of imports of crude and refined products to the area east of Montreal. The forecast, based on a well defined trend dependent on local markets, is probably conservative because the build-up of refining capacity east of Montreal will require that a greater portion of the Regional requirements arrive by water. In addition, some of the new refined products will be exported, which together with the additional crude oil requirement, will increase oil cargoes. The forecast increases in forest products are in line with the established growth trend. The general cargo volume growth may be conservative, as containerization is expected to divert volume from both U.S. and Canadian Great Lakes ports to the Atlantic Region.

The Atlantic Region growth forecast is mainly dependent on ore and petroleum growth. Despite normal uncertainties, the prospects for meeting the forecast volume of 64.1 million tons per annum by 1980 are considered to be good.

Great Lakes Region: The Great Lakes off-shore trade constitutes only 5.5% of the total Canadian off-shore cargoes. Grain is exported in the general absence of other outbound cargoes. The 1967 tonnage was probably increased by the lake shipping strike. The forecast shows no increase because the impact of containers is expected to reduce the availability of grain capacity, as fewer ocean-going ships will be present on the lakes. The petroleum cargoes consist of imports of special crude feedstocks and refined products for which there is insufficient local refining capacity. The growth of this volume is expected to be slow. The general cargo tonnages are forecast to remain at the 1970 level. Containerization of cargoes and its movement to Atlantic ports by unit-trains is expected to limit general cargo tonnage growth and, in fact, may even cause a decline.

The total 77% growth forecast for off-shore cargoes between 1967 and 1980 is mainly made up of increases in coal, iron ore and petroleum tonnages which are reasonably assured. However, off-shore trade is at present of significance to the Canadian shipbuilding industry only in respect to ship repairs as cargoes are almost entirely carried by foreign flag, foreign built ships.

CHAPTER II

SUPPLY OF SHIPPING SERVICES

Participation in Canadian Waterborne Trade

Coastal Trade

Vessels of Commonwealth flag registry are permitted to engage in Canadian coasting trade excluding the "inland" area west of Anticosti Island except in special circumstances. Immediately prior to the exclusion of these vessels in inland coasting trade in 1966, they accounted for 9.5% of inland coasting tonnage.

The participation by Commonwealth flag vessels in Pacific Region coasting traffic has been minimal in recent years. Pacific Region traffic consists largely of specialized tug and barge systems. The relatively small cargo market for self-propelled vessels is handled by Canadian flag operations with extensive supporting land pick-up, delivery and marketing organizations. The opportunities for foreign flag involvement are limited.

The Atlantic Region coasting trade has the largest Commonwealth flag participation. The extent of this participation between 1963 and 1967 has been as follows:

	Participation of Commonwealth Flag Vessels in Coastal Trade		
	Atlantic Region		Canada
Year	Million Tons Cargo	%	%
1963	2.9	24.2	10.7
1964	2.2	17.0	8.7
1965	2.2	18.5	8.5
1966	1.7	14.5	2.8
1967	1.0	8.5	1.8

TABLE C-8

REGISTRY OF VESSELS CARRYING CANADIAN INTERNATIONAL TRADE

1963 - 1967

(million tons cargo)

REGION & TRADE	1963		1964		1965		1966		1967	
	tons	%	tons	%	tons	%	tons	%	tons	%
Pacific:										
Canadian Flag	2.5	13.3	2.4	10.9	2.9	12.6	3.4	14.0	3.9	15.0
U.S. Flag	1.2	6.4	1.2	5.5	1.5	6.5	1.4	5.8	1.4	5.4
Other Foreign Flag	15.1	80.3	18.3	83.6	18.6	80.9	19.4	80.2	20.7	79.6
Total	18.8	100.0	21.9	100.0	23.0	100.0	24.2	100.0	26.0	100.0
Atlantic:										
Canadian Flag	0.8	1.4	1.3	2.2	1.5	2.4	1.2	1.9	1.5	2.7
Other Foreign Flag	50.7	98.6	58.2	97.8	61.0	97.6	60.9	98.1	54.8	97.3
Total	51.5	100.0	59.5	100.0	62.5	100.0	62.1	100.0	56.3	100.0
Inland:										
Lakes & Seaway -										
Canadian Flag	27.1	64.6	27.9	59.3	30.5	65.0	37.3	78.2	35.3	75.1
U.S. Flag	7.2	17.2	8.8	18.7	6.0	12.8	5.3	11.2	7.8	16.4
Other Foreign Flag	7.6	18.2	10.4	22.0	10.4	22.2	5.1	10.6	4.0	8.5
Total	41.9	100.0	47.1	100.0	46.9	100.0	47.7	100.0	47.1	100.0
Offshore:										
Foreign Flag	3.4	100.0	3.7	100.0	3.4	100.0	3.0	100.0	3.5	100.0
Total International Trade:										
Canadian Flag	30.4	26.4	31.6	23.8	34.9	25.7	41.9	30.6	40.7	30.6
Other Foreign Flag (including U.S.)	85.2	73.6	100.6	76.2	100.9	74.3	95.1	69.4	92.2	69.4
	115.6	100.0	132.2	100.0	135.8	100.0	137.0	100.0	132.9	100.0

Source: DBS

The last column of the table shows the percentages of Canadian coastal cargoes in all regions that were carried by Commonwealth flag vessels, including Commonwealth participation in "inland" trade of 1.9, 2.3, and 2.2 million tons in 1963, 1964 and 1965 respectively, until prohibited in 1966.

While Commonwealth flag participation remained substantial in 1967, it had been declining since 1963. Most of the cargoes carried in Commonwealth flag ships in 1966 and 1967 was bulk cargoes including petroleum and minerals as regular trades.

International Trade

Table C-8 shows the share of international cargo markets held by Canadian, U.S. and other foreign flag vessels in the Pacific, Atlantic and Inland regions, from 1963 to 1967.

In the Pacific Region, the Canadian flag participation in international trade consists almost entirely of tug and barge systems carrying cargoes along the Pacific coast; there is little participation in off-shore trade. The Canadian flag share of the Canada-U.S. Pacific coast cargo market was 50% in 1967 and has been increasing gradually since 1963. The highly sophisticated and frequently specialized barges are competitive with foreign self-propelled vessels in this coastal traffic.

In the Atlantic Region, Canadian participation consists of both small vessel coastal trade with the U.S. Atlantic seaboard, and bulk petroleum and ore traffic with off-shore areas by the small Canadian flag ocean-going fleet, supplemented in the off-season by inland vessels with ocean-going capability.

TABLE C-9

SIZE AND COMPOSITION OF CANADIAN-FLAG COMMERCIAL FLEET

DECEMBER 31, 1967

	Coastal							
	Atlantic		Pacific		Inland		Total	
	No.	GRT	No.	GRT	No.	GRT	No.	GRT
Cargo - (1,000 GRT & over)								
Dry cargo/passenger	29	53,700	5	16,000	168	1,484,000	202	1,553,700
Tankers	12	53,200	3	4,500	34	83,900	49	141,600
Total - cargo	41	106,900	8	20,500	202	1,567,900	251	1,695,300
Other:								
Passenger	-	-	5	18,100	-	-	5	18,100
Ferries	17	84,800	21	73,400	2	3,000	40	161,200
Total self-propelled	58	191,700	34	112,000	204	1,570,900	296	1,874,600
Tugs (100 GRT & over)	39	6,100	70	18,400	27	8,000	136	32,500
Barges, scows (")	326	85,200	1,026	549,400	23	47,000	1,375	681,600
Total-Coastal and Inland	423	283,000	1,130	679,800	254	1,625,900	1,807	2,588,700
Ocean-going:	4	65,000	-	-	-	-	4	65,000
TOTAL	427	248,000	1,130	679,800	254	1,625,900	1,811	2,653,700

Source: Water Transport Committee,
Canadian Transportation Commission

The Canadian flag share of the Inland Lakes and Seaway international trade, while fluctuating from year-to-year, has increased from 65% in 1963 to 75% in 1967. There was a sharp decline in foreign flag vessels trading permanently on the lakes in 1966, when these vessels were withdrawn (and many transferred to Canadian registry) due to their exclusion from the inland coasting trade. To a great extent, the current participation of foreign (non-U.S.) vessels in the inland international trade arises from their presence on the lakes to take on or discharge off-shore cargoes. Canadian flag dominance of the inland trade arises from the specialized nature of the vessels, and advantages over the U.S. in both capital and operating costs.

The Canadian Commercial Fleet

Size and Composition

Table C-9 shows the size and composition of the Canadian flag commercial fleet as at December 31, 1967. (Data on the fleet in later years is available, but 1967 fleet figures are used because trade data is available only to that year). The fleet consisted of 1,811 vessels totalling 2.65 million GRT, but this does not include approximately 270 small self-propelled vessels of under 1,000 GRT totalling 85,000 GRT.

The largest segment of the fleet is the inland vessels, consisting mainly of bulk dry cargo ships. Despite a very substantial increase in the inland fleet from 1 million GRT in 1959 to 1.6 million in 1967, approximately 25% of the gross tonnage was over 50 years old in 1967.

Barges in the Pacific Region constitute the second largest segment of the fleet, totalling 550,000 GRT in 1967. Tug-barge systems dominate the Pacific coastal trade situation, but are relatively minor in other areas. Of the Atlantic Region barge and other vessel fleet of 85,000 GRT, only an estimated 30,000 GRT is in cargo carrying service, the rest being dredges and supporting scows.

The total Canadian coastal self-propelled cargo fleet over 1,000 GRT consisted of 49 vessels totalling 127,400 GRT, 85% of which was located in the Atlantic Region. In addition, most of the 269 cargo vessels of under 1,000 GRT, totalling 85,000 GRT, were located on the Gulf of St. Lawrence and Atlantic coast.

The commercial, non-cargo carrying portion of the total Canadian fleet consisted of 5 passenger vessels (18,000 GRT) and 40 ferries (161,000 GRT). The passenger vessels were all located on the Pacific coast, being used mainly for seasonal cruise service. The ferries are mainly engaged in government operated or directed services between the mainland and islands and isolated coastal communities, on both coasts.

In 1967, the Canadian flag ocean-going fleet consisted of 4 vessels totalling 65,000 GRT. These consisted of 2 combination ore carriers - tankers, 1 dry cargo ship and 1 tanker. All of these were primarily in Atlantic service. In addition, there were a number of coastal and inland vessels which had ocean-going capability, consisting of 11 coastal vessels (50,000 GRT) and 7 inland vessels (77,000 GRT). With one exception, all of these were involved in Atlantic Region trade.

TABLE C-10

COUNTRY OF BUILDING OF CANADIAN REGISTERED SELF-PROPELLED VESSELS OF 1,000 GRT AND OVER
(as at December 31, 1968)

	Coastal Fleet											
	Atlantic		Pacific		Total		Inland		Deep Sea		Total	
	No.	GRT	No.	GRT	No.	GRT	No.	GRT	No.	GRT	No.	GRT
Canadian built	37	153,159	24	72,804	61	225,963	119	1,181,938	4	64,915	184	1,472,816
Foreign built:												
U.S.A.	6	20,736	5	17,781	11	38,517	48	320,102	-	-	59	358,619
U.K.	18	34,044	5	21,195	23	55,239	16	52,027	-	-	39	107,266
Germany	1	6,066	1	2,599	2	8,665	-	-	-	-	2	8,665
Norway	-	-	1	1,791	1	1,791	-	-	-	-	1	1,791
Sweden	1	2,356	-	-	1	2,356	-	-	-	-	1	2,356
Eire	-	-	-	-	-	-	1	18,127	-	-	1	18,127
	26	63,202	12	43,366	38	106,568	65	390,256	-	-	103	486,824
TOTAL	63	216,361	36	116,170	99	332,531	184	1,572,194	4	64,925	287	1,969,640

Source: Water Transport Committee
Canadian Transportation Commission

Source of Ships for the Canadian Fleet

Table C-10 shows the source of vessels for the Canadian self-propelled fleet as at December 31, 1968. The totals include dry cargo vessels, tankers, ferries and passenger ships of 1,000 GRT and over.

The table shows that about 75% of the vessels were Canadian built, including all of the small deep-sea fleet, 75% of the inland fleet and 68% of the coastal fleet. The major foreign source was the U.S. with 18% of the fleet (more than one-half the foreign built total) and the U.K. (5%).

The U.S. built vessels in the Inland fleet consist almost entirely of old bulk carriers (average age over 50 years) transferred from Commonwealth registry in 1965 and 1966 when the inland coasting trade was closed to non-Canadian vessels. Since 1959, there have been only two new foreign built vessels totalling 36,500 GRT added to the inland fleet as compared with 47 new Canadian built vessels totalling 624,000 GRT. Foreign yards have not been a significant source of vessels for the inland fleet in recent years.

In case of the self-propelled coastal fleets, 29% of the Atlantic fleet and 37% of the Pacific fleet were foreign built. The latter includes all 5 passenger ships totalling 18,000 GRT. In the case of the Atlantic fleet, there is a history of frequent transfers of registry particularly for smaller coastal vessels.

There are no readily available statistics on the source of tugs and barges. However, a sampling of additions to the

Pacific Region barge fleet from 1965 to 1967 indicates imports of only 1,600 GRT of a total of 165,500 GRT added to bring the fleet up to 550,000 GRT. There is no question that in recent years Canadian yards have been almost the total source of barges for the area.

CHAPTER III

SHIP AND TRANSPORTATION TECHNOLOGY

Waterborne Transportation Developments

Developments in water transportation as far as this study is concerned are discussed in terms of ship developments, cargo handling developments and changes in vessel environment.

Ship Developments

Ship developments in the 1970's will probably not match the great, almost revolutionary, developments of the 1960's, as is discussed more fully in Appendix VI. There will, however, be continued increases in speed, size, specialization and automation. These factors will be combined to the greatest extent in the containerships which will go into operation in the early 1970's. Although the average size of vessel will continue to grow for a number of years as the tonnage now under construction or planned comes into service, there will probably be some levelling off in the increase in size of vessels after the mid 1970's. While larger vessels are technically possible, limitations in the form of shore facilities, insurance and pollution risks will be encountered.

Developments in ship technology do not have any startling application to Canada's present fleet which is almost exclusively inland and coastal in character. Increases in the efficiency of inland vessels through improved propulsion machinery (e.g. gas turbines) and increased engine room automation are possible although the effectiveness may be limited by government and union regulations.

The 1970's will see the advent of 1000' upper lakers in U.S. and these may be appropriate for the growing Canadian ore trades.

The 1970's will probably see a large number of barges in deep-sea service, and the development of new or improved design features such as adequate surge towing gear or pusher-link devices. Such developments are most likely on the Pacific coast. The smaller crews which tug-barge systems use would act to narrow the wage cost penalty which Canadian flag vessels face in comparison with most foreign ships. The pusher-link would also make feasible the use of tug-barge systems in the lakes and seaway bulk cargo trades.

The impact in the 1970's of these developments is generally expected to be gradual, although accelerating toward 1980. In particular, the lakes and seaway systems have very large investments in conventional equipment and, historically, new developments have been incorporated gradually on a replacement basis; however, a trend toward self-unloaders appears to be developing.

Another ship development of particular Canadian interest is the ice strengthening of ships to lengthen navigation seasons particularly in the Arctic and Gulf of St. Lawrence and lower St. Lawrence River regions. Continuing studies of ice and accumulating experience have provided much of the information necessary to make year round navigation feasible in many areas. The main benefit would be longer navigation seasons and possible higher utilization of vessels.

Against this advantage must be weighed the higher capital cost of the vessel, and the penalty to its cargo carrying capacity and operating cost of its greater weight. The cost penalty of ice strengthening must therefore be assessed in the light of the trades in which the vessel will be employed.

The 1970's will also see broader application of new developments such as ACV's, hydrofoils and catamaran hulls. However, in most cases these will be in relatively small scale specialized service so that they are not likely to cause any significant displacement of conventional shipping services.

Cargo Handling

The most publicized development in cargo handling has been the advent of the container, although there have also been major improvements in bulk cargo handling. The trend is that new ships will be self-contained and independent of shore based unloading facilities, other than for wharfage.

The matter of containers and their economics have been widely reported and it is not intended to repeat the fundamentals of their use here. The full impact which containers will have is not yet discernible, but a number of effects to the Canadian trade situation can now be foreseen.

(a) A wider range of goods may be containerizable than is now generally considered feasible. A large portion of Canadian imports are well suited for containers. In general the exports are not as well suited, but they become economically containerizable if the container is otherwise returning empty. The advent of an economical "knock-down" container could alter this factor.

(b) The economics of containerships require large one-stop service so that inland consolidation of shipments for movement to a deep-water port is necessary. The Canadian volume will only support a limited number of such large scale port operations. The main losers in this development will be the Seaway and the inland and secondary ports which will lose general cargo volumes. On the Pacific coast, the position of Vancouver as a container port is not clear, but it will face severe competition from Seattle by reason of the latter's early start.

(c) There may be some restructuring of secondary transportation networks to support the main container port operations. This would apply mainly on the Atlantic coast where a feeder network would develop from ports losing their direct overseas shipping operations.

The container carried on a unit-train has also created the possibility of a "land-bridge" across North America to carry Europe to Asia cargoes, avoiding the Panama Canal. In this concept, Canada would have to compete with the U.S. as to the location of the "bridge". While the development of the land-bridge is possible, it is not considered likely. At present, its economic (mainly time) advantage is narrow and this advantage is likely to be further eroded by advances in ship speeds and reductions in their operating costs through automation. Since railway operations tend to be more labour intensive than those of ships, the present "land-bridge" feasibility may eventually disappear due to cost increases.

Other methods of cargo handling, such as the LASH system are also in operation. The LASH system operates to best advantage where it can be directly connected to inland waterways, the U.S. Gulf to Northern Europe trade being the best example. No broad application of the LASH system to Canadian trades is expected. Canadian trade tends to be concentrated in low value bulk cargoes which cannot be economically handled in this way.

Vessel Environment

The larger ocean-going vessels coming into service have placed increased emphasis on harbour depths. As a result, existing harbours are being deepened (Sept. Iles), new facilities are being built (Roberts Bank & Saint John) and new developments are being located where deep-water is available (refineries at Pt. Tupper and Come-by-Chance). In the Canadian situation, this will tend to segregate ocean-going and inland shipping, as economical large deep-sea vessels (including containerships) will be too large to use the St. Lawrence above Quebec City and the Seaway systems. No enlargement of the Seaway is expected within the next 10 years because of the high capital cost and the alternative offered by unit-trains. While the construction of the Chignecto Canal is a possibility which would change traffic patterns in Eastern Canada, its potential effects have not been covered in this study.

It has been suggested that the navigation season on the entire seaway system could be lengthened by as much as 8 weeks by a combination of ice reduction measures, including thermal devices (heating or bubbling), ice breaking and ice diversion (by booms, canals, etc.). The economics of such action are uncertain in the face of the considerable capital expenditure required. If undertaken it would reduce inland ship requirements by increasing utilization of existing vessels. However, no major development in this direction has been assumed to occur in the 1970's.

In the matter of the economic rather than the physical environment for ships, it is possible that seaway tolls will be increased.

Competitive pressures will however tend to limit the increase to a moderate one. In the other direction, no abolition of Seaway tolls has been assumed.

In the international shipping situation, the only major vessel environment change which would affect Canada would be a sea-level replacement for the Panama Canal. While still discussed, the prospects for such a development appears to be fading.

Competitive Transportation Developments

The main competitive transportation development which will have an effect on waterborne trade is the unit-train, which enables railways to substantially reduce the cost of carrying bulk cargoes without seasonal interruptions and much faster than by water transport. The most immediate example of unit-train utilization is the carriage of containers from inland centres to tide-water ports which is an essential part of the container system. Other potential applications of unit-trains which threaten trade are as follows:

(a) Grain can be carried from producing areas directly to deep water ports. The Wheat Board is in the process of establishing a block system of grain collection which would assure consistent availability of unit-train lots. A system of large regional elevators may also be established to clean and grade grain, eliminating the present bottleneck at Thunder Bay. Unit-trains are already in use between the U.S. mid-west and Gulf of Mexico ports and are reported to be highly successful.

(b) Coal may be carried by unit-trains from U.S. producing areas direct to Ontario consumers, avoiding Welland Canal tolls. This prospect is reduced by a change in the coal consumption pattern which will result in major coal useage above the Welland, which would benefit water transport, and by the fact that existing generating and steel plants may lack the room for unloading facilities.

(c) West coast lumber may move to its important U.S. east coast markets by unit-train, displacing the present water transport. This prospect is difficult to assess. Among other factors involved, it would probably require that the railway give the same service to interior B.C. producers which, at present, are their captive market.

The container and grain trades represent the most serious threats of the unit-train to waterborne trade. Both could cause major diversions of cargo from inland water transport. The unit-train has also helped water transport by making it feasible to ship inland products such as coal to overseas markets.

Solids pipelines, which are expected to be in operation in the late 1970's, are generally not expected to compete with water transportation except in some local situations. These pipelines are likely to displace truck and rail movement, over which they appear to have substantial cost advantages, rather than the relatively cheap water transport.

The development of air freight will eventually divert some overseas cargoes from ships. In the long term, such diversions may be substantial as aviation technology continues its rapid advance. However, during the 1970's, the growth of air freight will be confined to high value specialty products, and the increasing diversion is not likely to be noticed in the growing general cargo market.

CHAPTER IV

FUTURE DEMAND FOR SHIPS AND SERVICES

Commercial Demand

Commercial demand is defined here as demand arising from the cargo carrying sector, plus ferries, passenger vessels, tugs and other non-cargo carrying ships, notwithstanding the fact that they may be being operated or subsidized by Provincial or Federal governments. This does not include naval or government vessels not directly involved in service to the public.

The future demand for commercial vessels will be derived from the following sources:

(a) Increased demand for cargo carrying capacity due to increases in trade.

(b) Increases in requirements for services, such as ferries, tugs for docking assists, etc.

(c) Replacement of vessels scrapped due to age or obsolesence.

Demand from Trade Growth

The method of forecasting demand due to trade growth is as follows:

(a) Waterborne trade volumes were forecast (Chapter I).

(b) Past ship traffic and cargo carried were analysed to determine vessel movement (in net registered tons) and share of cargo markets held by vessels of Canadian registry. A "tonnage ratio" was calculated consisting of cargo carried divided by total vessel movement in NRT, which provides a relationship between cargo carried and ship movement. Since both the share of market and "tonnage ratio" vary from year-to-year, the pattern was analysed and future values for these variables assumed.

(c) On the basis of values assumed in (b) above and the cargo forecasts, future ship traffic requirements were forecast.

(d) The increase in fleet size from a selected base year was assumed to be proportional to the increase in vessel movement.

This method of forecasting does not purport to give other than a general estimate of future fleet growth. While uncertainties arising from such factors as surplus shipping capacity and major changes in trade patterns can be minimized by careful choice of a base year and review of projected cargo movements, such factors as increased vessel utilization arising from higher speeds, faster turn-around, etc., have not been incorporated in the forecast, except for replacement of old vessels. The additional vessel requirements have been forecast only for the Canadian flag fleet. Projections for international trade are limited to forecasts of vessel movement to obtain an indication of repair requirements and of ship types, should it be concluded that deep-sea vessels be built in Canada.

The basic assumptions with regard to shares of market and tonnage ratios are outlined in the Regional papers. In general, the assumptions are conservative since they provide for some reduction in the Canadian flag shares of markets from their relatively favourable levels of recent years.

The base fleet size used are as follows:

Pacific: 570,000 GRT consisting of all cargo vessels, tankers and barges as at December 31, 1967.

Inland: 1,500,000 GRT consisting of estimated 1966 vessel tonnage.

Atlantic: 266,800 GRT consisting of deep-sea fleet and coastal cargo vessels including an estimated 60,000 GRT in small (100-999 GRT) vessels and 35,000 GRT in barges estimated to be in cargo service as at December 31, 1967.

TABLE C-11

CANADA & REGIONS

SUMMARY OF TOTAL TRAFFIC & CANADIAN FLAG FLEET SIZE FORECASTS

Canadian Participation	1967 (actual)	1970	1975	1980
Pacific				
Coastal cargo (million tons)	20.2	25.6	33.6	40.7
International " "	3.9	4.5	5.6	6.7
Total	24.1	30.1	39.2	47.4
Vessel traffic (million NRT)	54.8	71.5	93.3	111.4
Canadian Flag Fleet size (000 GRT)	570	745	970	1,160
Inland				
Coastal cargo (million tons)	27.8*	25.9	28.7	31.5
International " "	29.4	42.2	51.1	60.7
Total	57.2	68.1	79.8	92.2
Vessel traffic (million NRT)	78.8	90.8	103.7	119.5
Canadian Flag Fleet size (000 GRT)	1,500	1,725	1,970	2,260
Atlantic				
Coastal cargo (million tons)	10.9	11.5	12.7	13.9
International " "	1.5	1.5	1.7	1.9
Total	12.4	13.0	14.4	15.8
Vessel traffic (million NRT)	79.4	83.6	92.6	101.2
Canadian Flag Fleet size (000 GRT)	267	282	311	340
TOTAL: Vessel traffic (million NRT)	193.0	246.0	287.0	332.0
Canadian Flag Fleet size (000 GRT)	2,337	2,752	3,251	3,760

The projections based on the foregoing assumptions are derived from trade growth are summarized on Table C-11 opposite. They indicate a potential increase of 936,000 GRT in the Canadian flag cargo fleet between 1970 and 1980, made up as follows:

	Fleet Size - GRT		
	1970	1980	GRT/annum
Inland	1,725,000	2,260,000	53,500
Coastal			
Pacific	745,000	1,160,000	41,500
Atlantic	282,000	340,000	5,800
Total	1,027,000	1,500,000	47,300
Total	2,752,000	3,760,000	100,800

The fleet increases forecast are those required to handle increases in commercial cargo demand only. No assumptions are made at this point as where these ships will be built, but this is returned to in later sections of this report.

Other Commercial Demand

The large ferry fleets on the Atlantic and Pacific constitute the major portion of the commercial non-cargo fleet. Additional vessel requirements would come from increases in traffic and/or the establishment of new routes. The establishment of new routes is difficult to forecast as the decisions involve political considerations at least in part.

The Pacific ferry fleet is relatively new and only some minor route additions are expected. A total of 10,000 GRT of new ferry construction is forecast for the 1970's, an average of 1,000 GRT per annum. Additional capacity to handle traffic growth is expected to be provided by the lengthening of existing vessels, which may involve major conversion work on as many as 8 vessels.

The Atlantic Region ferry services may be expanded slightly in the Prince Edward Island area. However, a number of additional vessels are on order for this region which are not included in these forecasts, and this will provide some increase in capacity. Additional ferry services will probably also be established in the Lower St. Lawrence area, but these cannot be forecast.

Tugs constitute the other major category of non-cargo carrying vessels in the fleet. In the Pacific Region an increase in the tug fleet, proportional to the increase in the barge fleet, would require construction of an additional 10,000 GRT of tugs during the 1970's, or an average of 1,000 GRT per annum. This may be somewhat conservative as the new larger barges expected to be built will require larger tugs.

There will also be some additional tug requirements in the Atlantic Region. As estimated 5 or 6 larger tugs will be required to assist in docking larger ore carriers and tankers. In addition, increases in barge traffic are expected in the Gulf of St. Lawrence which will require a number of larger tugs.

Demand for Replacement Vessels

The reason for replacement demand is considered here to be age and/or obsolesence. Losses of tonnage due to collisions and grounding have historically been relatively low and are not considered.

The various segments of the Canadian fleet have been analysed for replacement requirements which are summarized as follows:

Inland Fleet: In 1967, 68 vessels in the inland fleet, totalling 394,000 GRT were more than 50 years old. The replacement requirements are based on the assumption that all vessels reaching 45 years of age during the 1970's will be replaced but that because of increases in size speed and turn-around capability, replacement tonnage will only average 85% of the tonnage replaced. On the basis of 500,000 GRT reaching the age of 45 years during the 1970's replacement requirements are forecast at 425,000 GRT.

Pacific Coastal Fleet: The self-propelled fleet includes 10 vessels totalling 32,400 GRT which will be 30 years old during the 1970's. However, this includes 4 passenger vessels totalling 15,500 GRT used in cruise service for which replacement by new construction is highly uncertain, leaving only 17,000 GRT as replacement potential. The barge fleet is relatively new with approximately one-half of the total less than 12 years old. As a general estimate only, provision has been made for replacement of approximately one-third of the balance, totalling 80,000 GRT during the 1970's. The total replacement requirements for the Region would therefore be 100,000 GRT, an average of 10,000 GRT per annum. This replacement has been forecast on a ton for ton basis as no specific increases in efficiency can be estimated.

Atlantic Coastal Fleet: By 1975, 14 cargo vessels totalling 36,500 GRT will be close to or over 30 years of age. In addition, 117 small ships of between 100 and 999 GRT, totalling 33,000 GRT, will be 35 years old or older by 1975. (While this is the Canadian total most of these are assumed to be in the Atlantic Region). Total replacement requirements are estimated at 70,000 GRT at an average rate of 7,000 GRT per annum including aforementioned older ships. In the case of the small ships, it is felt that obsolesence as much as age will be a factor contributing to their scrappage. This replacement has also been forecast on a ton for ton basis, as the vessels involved are relatively small and no specific increase in efficiency can be estimated.

The total Canadian replacement requirements are therefore estimated at 595,000 GRT between 1970 and 1980, an average of 59,000 GRT per annum.

Summary: New Commercial Vessel Requirements

The following table summarizes the new ship requirements between 1970 and 1980, as outlined in the preceeding sections:

Forecast Vessel Construction - GRT 1970-1979

	East			West	Canada
	Atlantic	Inland	Total	Pacific	Total
Trade Demand	58,000	535,000	593,000	415,000	1,008,000
Other Demand	-	-	-	20,000	20,000
Replacement	70,000	425,000	495,000	100,000	595,000
Total	128,000	960,000	1,088,000	535,000	1,623,000
Average/Annum	12,800	96,000	108,800	53,500	162,300

The foregoing estimates are divided into "east" and "west" only in accordance with the market areas in which the demand will occur. There is no implication in this as to where the forecast vessels might be built. The only apparent physical limitations as to the place of building are that 1000' upper lakers could obviously only be built above the Welland Canal, and that very large ocean-going vessels could also only be built outside the Great Lakes.

Ship Types for New Construction

This section does not attempt to define in detail the types of new ship construction which will be required. However, the trade analysis and investigations have provided broad indications of the trends or demands which are outlined here.

In the Pacific Region, the main demand will be for barges. Of the total 515,000 GRT of new cargo vessels, possibly no more than 20,000 to 30,000 GRT will be self-propelled, and some of these will probably be self-propelled barges.

In the Atlantic Region, a significant increase in the barge fleet is expected. A substantial portion of the forecast small

Vessel (100-999 GRT) replacement of 33,000 GRT may be by barges. The new vessels for the self-propelled fleet will probably be larger, with more emphasis on faster turn-around and ice strengthening.

The additions to the inland fleet will primarily be bulk carriers of the straight and self-unloading types. A levelling off in the demand for package freighters is foreseen. It is also possible that there may be a demand from Canadian operators for a number of new 1000' upper lakers. The advent of new pusher tug-barge systems on the Great Lakes and Seaway systems is also possible to some limited extent in the 1970's.

Government Requirements

The Federal Government is a major purchaser of new ships for both naval and civil requirements. This section outlines the best estimates of these future requirements that could be arrived at based on discussions with government departments. In certain cases, these estimates only extend to 1975 because reviews of policies and alternative methods of providing services formerly provided by ships have not been completed.

In addition to the Federal Government ownership and operation of ships, a number of Provincial Governments operate ferry services. The most notable of these are the British Columbia Ferries and the Ontario Department of Highway. The requirements of these services have been covered previously in the "Commercial Non-Cargo" category. In most cases such services are an integral part of the

regional shipping pattern and must be analysed as a part of such a pattern. The same situation applies to the subsidized ferry, passenger and cargo operations of the Canadian National Railway in the Atlantic Region.

Government Naval Requirements

The Department of National Defence estimates for new naval construction cover only the 5 fiscal years to March 31, 1975. The construction estimates include only vessels already on order. These are summarized as follows:

Type	Year of Completion
1 - Supply Ships (OSS)	1970
2 - Destroyers (DDH)	1971
2 - DDE Conversions	1971
2 - Destroyers (DDH)	1972

The limitation of the forecasts to orders already placed reflects the major uncertainties in the role of naval vessels in Canada's defence policy, and in the vessel technology appropriate to the defence policy. It is reasonably certain that purchases of new naval vessels will continue after 1975, but the type (e.g. hydrofoils) number and value of vessels is uncertain. For these reasons, there is no provision in the forecasts for naval new vessel construction beyond the expiry of existing programs in 1972. This makes the forecast conservative beyond 1973 because:

- There will almost certainly be new naval vessel construction beyond 1975;
- The form of this construction may involve new technology where the shipyards' value contribution in the form of hull construction and machinery and equipment installation may be significantly different from present experience.

Government Non-Naval Requirements

The Federal Government departments which own, operate and/or charter ships are:

Department of Transport - Responsible for navigation, navigation aids including buoy tending, icebreaking and weatherships, search and rescue, and coastal patrol via the Canadian Coast Guard.

Department of Energy, Mines & Resources - Responsible for oceanographic and hydrographic research including charting, surveys, etc.

Department of Public Works - Responsible via its Marine Division for marine construction.

Department of Justice - Responsible via the R.C.M.P. Marine Division for law enforcement which requires patrol vessels in coastal areas and inland waterways.

Department of Fisheries & Forestry - Responsible for fisheries patrol and also the Fisheries Research Board engages in research in biology and fishing methods and in this function operates a number of ships.

Department of Transport:

The main need of this Department will be for icebreakers. The present estimate is for 3 new icebreakers being built by 1980, as follows:

1 -	Shallow draft inshore vessel of approximately 12,000 h.p. for St. Lawrence service; Approximate size	5,000 GRT
2 -	Polar icebreakers of approximate 60,000 + h.p. Approximate size each 24,000 GRT	48,000 GRT
	Total	53,000 GRT

Department officials have estimated that a total of 3 "Polar" icebreakers will be built but in view of the lead times required and the present status of these plans only 2 such vessels in the 1975-1979 period are included in the forecast.

The icebreaker construction makes some provision for expanded activity in the Arctic but falls short of a major understanding associated with large scale resource development.

Also under consideration is the replacement of 2 large Pacific weatherships with smaller vessels. While such new ships would be an interim measure pending the future assumption of weather surveillance by buoys and satellites, the expenditure may be justified on the basis of reduced operating costs. If undertaken, the replacement would require two vessels of approximately 1,600 GRT each.

The departmental requirements for buoy tending, patrol and rescue will be highly selective based on individual circumstances. In particular buoy tending is being taken over by helicopters. In most cases the additional requirements will be for relatively small craft, summarized as follows:

Buoy tenders: 2 - 3 small vessels of 60 to 75 feet.

Patrol boats: 3 - 4 mission oriented small boats of 70-120 feet for the Coast Guard.

Lifeboats: Approximately 10 additional 45' sea rescue boats required for both coasts.

The total small craft requirements of the Department are therefore for 15 to 17 vessels of the 45' to 120' size.

Department of Energy, Mines and Resources:

The present fleet of this Department consists of 12 ships, ranging from 460 to 3720 GRT (615 - 4,660 ton displacement) having a total tonnage of 14,651 gross tons (19,200 displacement). The current location of this tonnage is 62% Atlantic, 25% Pacific and 13% Great Lakes. The Department's comprehensive program for the 1970's requires 20 new ships but this may be reduced by program stretch-out and by vessel chartering. The best present estimate indicates potential Departmental procurement of 11 ships of varying sizes up to 3,800 GRT. There is no indication of the area of operation and "mix" of vessel sizes, but assuming a virtual duplication of the present fleet, the total new construction could amount to about 13,000 GRT.

Department of Public Works:

At present the Marine Division operates a fleet of approximately 110 vessels including dredges, scows, tugs, drill boats and work boats. These are all relatively small vessels.

The Department's additional and replacement requirements for the next 10 years have been estimated as follows:

Type	Size	Cost (est.)
1 - tug	100 GRT	$ 3,000,000
4 - tugs	40 GRT	1,500,000
20 - scows	36'	2,000,000
1 - survey boat	40'	500,000
Tenders (steel)		2,000,000
1 - dredge	-	500,000
		$ 9,500,000

TABLE C-12

SUMMARY OF GOVERNMENT REQUIREMENTS

1970 - 1979

TYPE AND NUMBER AND ESTIMATED SIZE	NEW VESSEL REQUIREMENTS (GRT)		
	1970-74	1975-79	Total
Naval:			
4 - DDH at 3,000 GRT each	12,000	-	12,000
1 - OSS at 17,500 GRT	17,500	-	17,500
	29,500	-	29,500
Department of Transport:			
1 - Shallow draft icebreaker at 5,000 GRT	5,000	-	5,000
2 - Polar icebreakers at 24,000 GRT each		48,000	48,000
	5,000	48,000	53,000
Energy, Mines and Resources:			
11 - Survey ships total estimate 13,000 GRT	6,000	7,000	13,000
Department of Public Works:			
4 - Tugs, total estimate 260 GRT	130	130	260
Department of Fisheries & Forestry:			
1 - Offshore survey vessel estimate 1,500 GRT	1,500	-	1,500
TOTAL	42,130	55,130	97,260

Note: Foregoing does not include smaller craft for various departments including:

Approximately 20, 36' scows
Approximately 29/33, 45'-120' launches, patrol boats, etc.
Approximately 5 , 50' - 90' fisheries research boats.

The dredge included above has been ordered. With the exception of the one large tug the requirements are for small vessels.

Department of Justice:

The R.C.M.P. Marine Division requirement for patrol vessels during the next 10 years is for relatively small craft including 10 boats of 45' to 75' long and 3 to 5 boats under 45'. All new boats under 75' are expected to be of fibreglass construction. If the surveillance of off-shore oil drilling activity is delegated to the R.C.M.P. a vessel of the 200' length range would be required. However, Coast Guard facilities might be used instead.

Department of Fisheries & Forestry:

The Department of Fisheries and Fisheries Research Board estimate their requirements for the 1970-1975 period as follows:

1 - 250' off-shore vessel for Atlantic Est. 1,500 GRT

Small Craft:
- 1 - 50' in-shore
- 1 - 50' harbour craft
- 1 - 80' " "
- 1 - 90' trawler/seiner
- 1 - oceanographic barge (for Pacific)

The estimated total cost of the program is $8.3 million, including the extensive research equipment which will be required aboard the vessels.

Summary of Government Procurement

Table C-12 opposite summarizes the government procurement of major vessels as reviewed in the preceding sections. In order to maintain a common basis of forecasting shipbuilding requirements, the naval and service vessels have been converted to a gross registered ton

basis. While this conversion has been made on the basis of the best available information, it is recognized that it is only approximate. Moreover the measure is imperfect because the labour and material requirements involved in government vessel construction are considerably higher than for cargo vessels of equivalent GRT rating. However, the effect of this on the total Canadian shipbuilding forecast is small because total government procurement on a GRT basis during the 1970's as presently estimated would be less than 6% of all Canadian shipbuilding, projected previously at 1,538,000 GRT. The dollar value would be considerably higher.

The government procurement forecast is probably conservative for the 1975-79 period because it does not provide for naval procurement. In addition, a number of other projects now considered to be only possible, such as two replacement weatherships, have not been included.

Fishing Vessel Demand

The Atlantic and Pacific Region papers provide details as to the situation in the fishing industry in each area. The comments following are a summarization only of the main sources of demand, and the forecasts.

Atlantic Region

The Atlantic Region is emerging from a depressed period due to world oversupply of fish. Limitations as to fish supplies may be a longer range problem, as some species particularly haddock already show signs of depletion. The main sources of demand for new steel

fishing vessels are as follows:

(a) moderate additions to the groundfish fleet size.

(b) replacement of old and obsolete boats, the obsolete boats being older side trawlers.

(c) the build-up of a herring seining fleet, as this segment of the industry develops, includes replacement of boats returning to the Pacific coast when that area is re-opened.

The forecast for additional vessel requirements has been based on the estimates of provincial authorities which, for the Atlantic Region, are as follows:

	Size	No.	GRT
Steel trawlers & trawler/seiners	80-115'	40	14,000
	140-160'	55	30,000
		95	44,000

Steel fishing vessel construction is therefore forecast at an average of 9-10 vessels per annum totalling 4,400 GRT per annum between 1970 and 1979.

This forecast does not cover wood vessels including in-shore vessels and crab and shrimp draggers which range from 45'-110' in length. The major portion of this demand is in Newfoundland where as many as 600, 45'-80' in-shore boats may be built during the 1970's. This building depends heavily on continuing subsidization and must be regarded largely as a socio-economic measure.

In other Atlantic areas there are indications of potential building of 30, 80'-110' wooden draggers. All the wooden boats would be built in small local yards.

TABLE C-13

CANADA

SUMMARY OF SHIPBUILDING FORECASTS

1970 - 1979

	1970-74	1975-79	Total
Commercial:			
Fleet increase	504,000	504,000	1,008,000
Replacement	297,500	297,500	595,000
Other	10,000	10,000	20,000
Total - GRT	811,500	811,500	1,623,000
- GRT/annum	162,300	162,300	162,300
Government:			
Naval	29,500	-	29,500
Other	12,600	55,200	67,800
Total - GRT	42,100	55,200	97,300
- GRT/annum	8,400	11,000	9,700
Fishing:			
Total - GRT	22,000	22,000	44,000
- GRT/annum	4,400	4,400	4,400
Total - GRT	875,600	888,700	1,764,300
- GRT/annum	175,100	177,700	176,400

Pacific Region

While the Pacific Region fisheries enjoy good markets, the growth is limited by a lack of further fish resources, particularly salmon and herring. The herring fishery is now closed to allow recovery of the species. Further uncertainty is created by the Federal government's attempt to upgrade the salmon fleet to a better equipped full time fishing operation. This has involved more stringent requirements to qualify for licenses and a gradual upgrading of performance standards.

The potential market for new steel boats is expected to come from the following sources.

(a) The upgrading of fishing operations into year-round operations using 110-120' boats useable as a combination of halibut fishing, herring seining, groundfish trawling and as salmon packers.

(b) Construction and re-equipping of new salmon boat by surviving license holders.

At present the majority of the Pacific Region fishing boats are relatively small, wooden vessels. These will probably be continued to be built by the small yards. However, there are major uncertainties as to when the overall upgrading of the fleet into larger steel boats will occur, and therefore,no reasonable forecast of fishing boat construction can be made for the Region. While it is probable that some boats will be built,the total tonnage in any year will be small in relation to building for commercial demand and has been ignored in the forecasts.

Summary of Shipbuilding Forecasts

Table C-13 summarizes the total forecast 1970-1979 shipbuilding requirements for the commercial, government and fishing

TABLE C-14

SUMMARY OF CANADIAN SHIPBUILDING ACTIVITY

1958 - 1969
(000 GRT delivered)

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	Total
Federal Government:													
Naval	3.2	11.5	-	.1	4.0	22.8	7.2	-	.5	-	0.2	17.8	
Other	1.2	13.1	9.0	9.7	4.2	6.3	0.9	6.8	8.0	19.7	25.9	22.7	
Total	4.4	24.6	9.0	9.8	8.2	29.1	8.1	6.8	8.5	19.7	26.1	40.5	194.8
Cargo:													
Dry cargo	66.3	21.5	79.3	64.5	63.3	109.1	52.1	150.1	80.6	97.2	110.2	46.5	
Tankers	7.8	26.9	27.0	6.3	25.1	4.9	8.9	7.1	-	4.7	-	34.6	
Total	74.1	48.4	106.3	70.8	88.4	114.0	61.0	157.2	80.6	101.9	110.2	81.1	1,113.9
Other Commercial:													
Ferries	0.8	-	3.9	0.6	7.2	2.0	2.8	1.4	-	-	2.8	2.0	
Barges	9.4	8.1	18.1	19.2	28.9	31.9	18.6	48.7	32.1	48.0	28.6	72.8	
Tugs	0.3	0.1	0.3	-	0.4	1.5	0.2	0.6	1.1	0.6	0.3	3.5	
Misc. (1)	0.2	0.3	0.4	-	2.0	0.4	38.7	0.2	21.7	1.3	0.3	1.1	
Total	10.7	8.5	22.7	19.8	38.5	35.8	60.3	50.9	54.9	49.9	32.0	79.4	453.4
Fishing Vessels	1.6	0.1	-	0.1	0.4	2.1	3.8	3.4	7.3	23.6	8.5	2.6	53.5
TOTAL	90.8	81.6	138.0	100.5	135.5	181.0	133.2	218.3	151.3	195.1	176.8	203.6	1,815.6

Source: Questionnaire to yards & DBS.

(1) Major items consist of ocean-going cargo/tankers (1964 & 1966) and floating dock (1966).

sectors as discussed in the preceding sections.

The table forecasts total construction of 1,764,300 GRT, at an average annual rate of about 176,400 GRT.

Table C-14 shows the deliveries by Canadian shipyards in the period 1958-1969. The following table compares the average annual shipbuilding between the 1958-1969 and the forecast for the 1970-1979 period.

	1958-69		1970-79
	GRT	GRT/annum	GRT/annum
Cargo and other Commercial	1,567,300	130,600	162,300
Government	194,800	16,200	9,700
Fishing	53,500	4,600	4,400
	1,815,600	151,400	176,400

It should be noted that the forecast is for total Canadian flag demand. Imports of vessels between 1958 and 1969 would have to be added to Canadian production, to arrive at the market demand during that period. Imports of new vessels (including major conversions) totalled approximately 120,000 GRT, or an average of about 10,000 GRT per year. (1)

On this basis the forecast calls for average new vessel demand during the 1970's to be a little greater than in the 1960's. There will however be a change in the mix of vessels

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(1) In addition, 245,000 GRT of used inland ships were transferred to Canadian registry in 1965 and 1966. These were, however, mainly in Canadian service prior to the transfer, so that they are not counted as fleet additions.

TABLE C-15

SUMMARY OF FORECAST INTERNATIONAL OCEAN-GOING TRAFFIC

1970, 1975 & 1980

	1967 (actual)	1970	1975	1980
Pacific Region				
Cargo tons (millions)	21.9	31.8	43.0	49.9
Vessel traffic*(million NRT)	54.8	80.0	108.0	125.0
Atlantic Region				
Cargo tons (millions)	54.8	60.8	69.4	79.2
Vessel traffic * (million NRT)	78.5	86.7	99.2	113.0
Great Lakes & St. Lawrence				
Cargo tons (millions)	3.4	3.7	3.8	3.9
Vessel traffic * (million NRT)	2.4	2.6	2.7	2.8
TOTAL				
Cargo tons (millions)	80.1	96.3	111.6	133.0
Vessel traffic * (million NRT)	135.7	169.3	209.9	240.8

* arrivals and departures.

produced. Government procurement accounted for 11% of all vessel deliveries between 1958 and 1969 but are forecast to total only 6% of deliveries during the 1970's. Barges accounted for approximately 19% of past output, but are expected to exceed 30% of all tonnage delivered during the 1970's.

International Trade

The preceding sections have included forecasts of ship demand from the Canadian flag fleet which will be required to carry coastal trade and that portion of international trade which Canadian flag vessels can reasonably expect to carry during the 1970's. For off-shore international trades, cargo tonnages have been forecast and vessel movement relationships to these cargoes have been established.

Table C-15 shows the forecasts of ocean-going traffic in net registered tons of arrivals and departures, by Regions and for Canada. The total traffic is forecast to increase from 135.7 million NRT in 1967 to 241 million NRT in 1980. This forecast has value as a broad indicator of vessel traffic and potential repair requirements. The actual numbers of arrivals and departures is not expected to grow proportionately with tonnage, as the average size of vessel will increase.

Other Major Demand Potential

The preceding forecasts of the demand for ships from the Canadian market included only demand from the commercial, government and fishing sectors which could be reasonably forecast from trends or developments in the trades, or on the basis of longer term plans as

in the case of government requirements. It did not include areas of possible demand which are difficult to forecast with reasonable accuracy or which require skills additional to those involved up to now in conventional shipbuilding. The two areas of major demand potential falling within these definitions arise from off-shore oil exploration and production, and Northern and Arctic resource development.

Off-Shore Oil Exploration and Production

The world is now undergoing a boom in off-shore oil drilling, made possible by the development of mobile rigs and prompted by the fact that many of the potential producing areas are close to their ultimate markets. Canada is sharing in this activity as drilling is either planned or underway off the Pacific, Atlantic and Arctic coasts and in the inland waters.

The type of floating equipment required depends on the phase of the development, whether it is exploration or production. The requirements of the exploration phase include:

Geophysical vessels to explore ocean floor geology and determine drilling sites.

Drilling vessels or rigs from which the exploration hole is drilled.

Support vessels including tugs to move and position rigs, supply boats for bringing in materials, crew boats to transport personnel.

If the exploration is successful, and the well enters the production phase, the following vessels are required:

Production platforms (if permanent surface structures are used).

Construction vessels, including crane and pipe laying barges and surface support vessels for constructing pipelines, or storage and mooring facilities.

The foregoing is only a general indication of the vessel requirements. There are for example a variety of drilling rig types ranging in cost from $2 to $15 million each. Support vessel requirements depend on local conditions.

The longer term demand for exploration and production equipment for Canadian off-shore waters (including Pacific, Arctic and Atlantic) will depend largely on the success of the exploration effort. In the initial phase which will last to 1972 or 1973, about 12 survey vessels, 7 drilling rigs and possibly 18 support vessels may be employed in Canadian waters. These could be increased several times if a significant discovery spurs increased exploration activity. Discouraging exploration results could reduce work to the level where existing equipment could handle the reduced level of activity.

The uncertainties in the demand situation make it very difficult to be at all precise regarding future requirements for off-shore drilling equipment and support vessels. This whole matter is being assessed in detail by the Canadian Transport Commission in its inquiry respecting the coasting trade of Canada and related marine activity, and it is anticipated that the results of its investigations will be a more complete and thorough statement of possible demand than has been available hitherto.

Policies adopted on the coasting laws for this class of equipment in off-shore activity, following the Commission's report, will be a most important determinant of the ability of Canadian yards to compete in these new markets. They have commenced the construction

of drilling rigs, but since the supply of rigs, support craft and services is open to world competition, Canadian yards are in an unfavourable supply position if present legislation is not changed.

Northern Resource Development

The Northern and Arctic areas of Canada are generally geologically favourable to the presence of petroleum and mineral deposits. Intensive exploration activity, although receiving wide publicity, is only beginning. Despite the fact that high exploration, operating and transport costs will require that the discoveries be of exceptional quality to be commercially exploitable, it is reasonable to expect that a number of major developments will be in production or under way during the 1970's. The best immediate prospects would appear to be oil discoveries in the Mackenzie Delta and the Arctic islands, and the known iron ore deposits on Baffin Island. Other mineral deposits offer the main potential for later development, the main possibilities, as outlined for the Committee by the Department of Indian Affairs and Northern Development, being iron ore at Snake River, copper at Coppermine, lead and zinc at Strathcona Sound, and sulphur in the Queen Elizabeth Islands.

The ship requirements for Northern resource development include the following:

Supply vessels for the exploration and development phase, including lighters, barges and tugs.

Bulk cargo vessels, including large tankers, all ice strengthened and specially powered for Arctic operation.

Tugs, mainly large powerful types to assist in docking bulk cargo vessels and provide local ice breaking services.

Not included in the foregoing are additional polar type ice breakers which might be required from the Federal Government if large scale development occurs.

Any forecast of ship demand is obviously impossible as the rate of mineral and petroleum discovery and development cannot be predicted. The implications of such new shipping demands to the Canadian shipbuilding industry will depend in large part on the ultimate destination of the resources. At present, it appears that some of the oil and most of the iron ore and other minerals would be marketed in Europe and the transportation would constitute international shipping. However, oil destined for Canada would constitute coastal shipping. The status of local support vessels will depend on coastal law policy.

Summary

The absence of any firm forecast or estimate of Canadian demand for ships and shipping services for off-shore oil exploration and development, and Northern resource development, should not be construed as implying scepticism regarding the demand potential. There is little doubt that this potential is great but the rate of resource discovery and development cannot be predicted, particularly within the relatively short 10 year forecast period. This potential is additional to the commercial and government demand forecasts covered in the preceding sections.

The effect of this potential demand on the Canadian shipbuilding industry depends largely on Federal Government policy regarding the enforcement of Arctic sovereignty and the application of the coasting

laws to off-shore activity. At the least, the servicing and repair of Arctic development vessels should be a source of activity for the marine industry even if there is no major direct participation in the Arctic by Canadian built and registered ships. The shipbuilding and shipping industries would have to expand their range of skills to take the maximum advantage of the new potential, but there is no doubt that this can be accomplished to cover a large part of such a committment.

Demand For Repair Services

In the years 1958 to 1967, repair activity constituted between 19% and 33% of the value of the total activity of the Canadian shipbuilding and repair industry. Repair activity was stable in 1958-63 at $40-45 million per year, subsequently rose to $64 million in 1967, and the preliminary value reported for 1968 is $59 million. In recent years, repairs have accounted for just over 20% of total industry activity.

Information as to the composition and regional distribution of the industry's repair activities is limited. D.B.S. publishes only a national total for repairs without any breakdown of regional activity or nature of work performed. An attempt was made to obtain more information on repair activity by questionnaire. However, the questionnaire yard population was not representative of the industry in this respect since questionnaires were sent to yards mainly engaged in building and carrying on repairs was a lesser activity. This is pointed up by the fact that while questionnaire yards accounted for

TABLE C-16

CANADA & REGIONS

REPAIR WORK DONE BY QUESTIONNAIRE YARDS

(AVERAGE 1958-1969)

	Canada	Regions			
		Atlantic	St. Lawrence	Great Lakes	Pacific
Value of repairs to all work - %	16	28	10	11	25
Value of damage repairs to all repair work - %	21	15	15	45	26
Repairs to Canadian flag vessels to all repairs - %	73	86	55	95	60

Source: Questionnaire to Yards

90-95% of new building activity, the total value of repair work reported by the questionnaire yards was only about one-half of all the repairs done by the industry. Furthermore, repairs constituted only about 15% of total activity in questionnaire yards as compared with 59% of total activity in non-questionnaire establishments.

Recognizing both the limitations of the questionnaire sample and the fact that some degree of estimation underlies the data, Table C-16 summarizes the basic characteristics of repair activity and the repair market in Canada and the Regions experienced by questionnaire yards. The main observations are summarized as follows:

Atlantic Region:

Repairs account for the highest proportion of total yard activity for any Region in Canada, at 28% being slightly higher than the 25% experienced in the Pacific Region. A very large portion of the work, 86%, is on vessels of Canadian registry, and only 15% of all work is damage repair. The major portion of the Atlantic Region repair market is therefore regular maintenance on Canadian flag vessels.

St. Lawrence:

Repair activity in this Region constitutes only 10% of all work, the smallest proportion of all Regions. Damage repairs, at 15% of all repairs, have also been relatively small, but a relatively high proportion of all repair work, 45%, has been done on foreign ships.

Great Lakes:

Repair activity at 11% is a relatively small proportion of total work. Moreover, almost one-half of this work is damage repair, and almost all (95%) of the work is done on Canadian vessels. To a greater extent than in other Region, the Great Lakes repair facilities exist as an emergency repair operation for the Canadian fleet.

Pacific:

Repairs constitute a relatively high proportion of total work (25%). Damage repairs, at 26% of all work, are exceeded only by the Great Lakes. Only 60% of the total repair work is done on Canadian vessels so that the foreign vessel repair market is important to the Region.

The available data shows that a very substantial repair capability exists apart from the basic shipbuilding activity which provides the skilled labour facilities and flexibility required for major repair services. Since the questionnaire yards account for 90-95% of Canadian shipbuilding activity, then 50% of all repair work was clearly independent of any substantial shipbuilding operation. While it may be suggested that major repairs were done and could only be done at the larger yards, the practice is that many smaller establishments can provide substantial repair services afloat.

Repair Forecasts

The demand for repair services derives from the following sources:

a) repair on an emergency basis and refit of Canadian flag vessels on a regular basis, particularly for the inland and coastal fleets

b) repair and refit of government naval and service vessels on a regular basis (with some of this work captive to government facilities)

c) repair on an emergency basis and some refit of foreign flag vessels recognizing that they usually obtain major maintenance in home countries.

Ideally, it would be desirable to forecast total repairs as the total of the forecasts for each of the above demand sources. In reverse order, repairs for foreign flag vessels would

be derived from trade projections and the emergency repair experience of questionnaire yards. Government and commercial repair demands could be related to the size, age and composition of the fleets. As indicated previously, the lack of data on the composition of past repair activity does not allow this type of comprehensive forecast.

The purpose of the projection in this forecast is only to indicate the approximate magnitude of repair activity that will be additional to basic new construction activity for Canadian yards in future years. For this limited purpose, the forecast is made based on the relationship between repair volume and fleet size. The following table shows this relationship, including only commercial vessels of 1,000 GRT and over.

	Repairs		Canadian Flag Fleet Size (1,000 GRT+)	
	$ Millions	Index 1958 = 100	000 GRT	Index 1958 = 100
1967	$ 64	145	1,918	156
1966	56	127	1,761	143
1965	57	130	1,460	119
1964	47	107	1,441	117
1963	44	100	1,372	111
1962	37	85	1,325	108
1961	45	102	1,307	106
1960	45	102	1,257	102
1959	45	102	1,227	100
1958	44		1,229	100

Sources: DBS Shipbuilding & Repair Industry

A relationship between repair activity and fleet size is only approximate, but the estimated future repair activity based on this relationship is as follows:

	Fleet Size 000 (GRT) *	Repairs $ million/annum
1980	2,632	$ 94
1975	2,403	86
1970	2,020	72
1967	1,918	64
1958	1,229	44

* 1,000 GRT and over

This is an aggregate forecast of potential demand for repairs in Canadian yards. Within the total, there will be an increased need for repairs to larger-sized ships, including bulk carriers of 300,000 DWT or more. The largest existing facilities on the Atlantic and the Pacific coasts and in the St. Lawrence region can now only dry-dock vessels up to 85,000 - 100,000 DWT.

Major Conversions

Major conversion work is included as new construction activity in DBS industry statistics, but in the statistics obtained from questionnaire yards conversions were included in "other" work.

Potential conversion opportunities have not been included in the forecasts because of uncertainty as to size and timing. Some major possibilities are:

- lengthening as many as 8 ferries in the Pacific Region to provide increased capacity to meet traffic growth
- upgrading and modernizing inland bulk carriers, including conversions to self-unloaders

The foregoing examples are not intended to be all inclusive but represent only the main foreseeable prospects.

CHAPTER V

THE SUPPLY POSITION OF THE SHIPBUILDING INDUSTRY

Introduction

In assessing the supply position of the Canadian shipbuilding and ship repair industry, it is desirable to examine the following aspects:

- the level and composition of activity
- the economic resources used
- the facilities and methods employed
- the industry's relative competitiveness

These matters are discussed below for Canada as a whole and for regions in later sections of the report. As a preamble, however, it is necessary to refer to certain procedures adopted regarding statistics on the industry.

The Dominion Bureau of Statistics classified 74 establishments as being in the Canadian shipbuilding and repair industry in 1967, with a value of output in that year of $286 million.

The bulk of the activity and output is in the larger yards, the D.B.S. data being as follows for 1967 (although it should be noted that 2 of the larger yards closed subsequent to 1967):

	Number of Establishments No.	Number of Production Workers No.	Value of Output $ Million
Establishments with output:			
Less than $1 million	41	1,126	$ 16
$ 1 - 5 million	21	2,067	34
Over $ 5 million	12	12,210	236
Total	74	15,403	$ 286

A large number of the smaller yards are builders and repairers of small craft only, and their operations are not germane to the Committee's terms of reference. However, a consequent statistical limitation is that the number of medium-sized and larger yards is too few for D.B.S. to provide detailed regional break-downs while maintaining confidentiality.

Since the Department of Industry, Trade and Commerce also restricted the detail of the information it could supply from its records, the Committee was obliged to approach a sample of the yards in Canada for detailed information by questionnaire and by personal visit. The yards selected for survey were those which had received $100,000 or more in construction subsidy in recent years, this being taken as evidence of substantial building operations of larger-sized vessels.

Excellent co-operation was extended by the yards that were approached, and questionnaire responses were received from 22 yards that had a total value of work performed in 1967 of $233 million. The other 20% or so of total industry output is made up of:

- the output of the numerous smaller yards
- The output of the two larger yards which have closed since 1967. Apart from these, all the yards with output over $5 million replied to the questionnaire.

The questionnaire data which is utilized in this report thus refers to yards that were operating at the end of 1969 and that are estimated to have produced in excess of 90% of the industry's total output in that year. The composition of the questionnaire yards indicates that the questionnaire data represent not far short of 100% of the new construction

TABLE C-17

CANADA
ACTIVITY IN THE SHIPBUILDING
AND REPAIR INDUSTRY, BY CATEGORY

	Value of All Work Performed $ Million	Value of New Construction Work $ Million	Value of Repair Work $ Million	Value of Conversions and Industrial Work $ Million
Questionnaire Yards (not the total Industry)				
1969 Est.	$ 233	$ 132	$ 32	$ 69
1968	240	141	39	60
1967	233	146	32	55
1966	235	112	35	88
All Yards				
1968 Prelim	264	154	59	51
1967	287	161	64	62
1966	294	139	56	99
1965	275	130	57	87
1964	234	126	47	61
1963	209	130	44	35
1962	172	103	37	33
1961	138	63	45	31
1960	148	70	45	34
1959	144	72	45	27
1958	150	77	44	28
	Per Cent	Per Cent	Per Cent	Per Cent
Questionnaire Yards (not the total Industry)				
1969 Est.	100%	56%	14%	30%
1968	100	59	16	25
1967	100	62	14	24
1966	100	47	15	38
All Yards				
1968 Prelim	100%	58%	22%	20%
1967	100	56	22	22
1966	100	47	19	34
1965	100	48	21	31
1964	100	54	20	26
1963	100	62	21	17
1962	100	60	21	19
1961	100	45	33	22
1960	100	47	31	22
1959	100	49	31	20
1958	100	52	29	19

Sources: 1. Questionnaire to Yards representing 80% of the value of work performed by all yards.

2. D.B.S., Shipbuilding and Repair Industry.

Notes: 1. The value of all work performed corresponds to the D.B.S. value of shipments of goods of all manufacture.

2. D.B.S. data include reconditioning and conversion with new construction. The questionnaire data group reconditioning and conversion with industrial work.

activity in 1969 and over 80% of the combined total of conversions and industrial work. Questionnaire data are less representative, however, of the repair operations by the industry, accounting for perhaps one-half of the total.

The information obtained from analysis of the questionnaires provides a most useful supplement to the primary source data from D.B.S. It might be mentioned that there are other sources of statistics for the shipbuilding industry in Canada e.g. the former Canadian Maritime Commission and the Canadian Shipbuilding and Ship Repairing Association. Data from these sources have been used only to a very limited extent, since several sets of data prepared on different bases of definition are more likely to confuse than to assist the analysis. All data are clearly identified as to source.

The Level and Composition of Activity in the Industry

Production activity in the Shipbuilding and Repair industry comprises the construction of new ships, reconditioning and conversion of existing ships, ship repairing, and manufacture of fabricated industrial products (including hydro electric and nuclear plant equipment, penstocks, tanks, gates, subway cars, furnaces, freight cars, pulp and paper machinery, pressure vessels, structural steel, miscellaneous machinery and items produced under defence sharing arrangements).

All Activities

Table C-17 shows the level and trend of the value of work performed in total and by category since 1958. This year was chosen as

the base year since it predates both the St. Lawrence Seaway (opened in 1959) and the shipbuilding subsidies introduced in 1961. Data are shown for all yards until 1968, the last year for which D.B.S. provides information. To give a more recent view, data are also shown for the questionnaire yards which comprised the sample drawn from some of the medium and all the larger yards that were operating at the end of 1969. Such yards gave preliminary estimates of their activity for all of 1969, along with actual data for prior years. A relatively minor difference in the D.B.S. and questionnaire data for categories of activity is described in the footnote to the Table.

Looking first at the trend in developments, total activity was declining at the beginning of the 1960's until changed trading conditions and the introduction of subsidy gave a stimulus to new construction in Canada. Total activity expanded strongly through the mid 1960's under the influence of buoyant economic and market circumstances and reached a peak in 1966. There has subsequently been a decline in the value of industry activity which is not revealed by the 1966-69 data for the questionnaire yards (this data does not include the operations of the yards active in 1966 and 1967 which were subsequently closed).

By category of activity, new construction reached its peak in 1967 but has fallen off since, the extent of the decline being somewhat greater than indicated by the data because yards now closed were building in earlier years. The value of repairs was

quite stable in 1958-64, increased substantially after that, and apparently has continued at this higher level recently. The amount of other work (industrial activity in the D.B.S. data; industrial and conversion work in the questionnaire data) grew slowly in 1958-63, expanded very substantially in 1965 and 1966, and then declined to levels which continue, however, to be more than double those of the early 1960's.

As the information in the bottom half of Table C-17 shows, new construction has been between 45% and 62% of total activity in all the yards during the period, the proportions for the questionnaire yards being generally higher. Although repairs increased substantially in dollar value, they declined in importance from one-third of total work at the beginning of the '60's to about 20% at the end (this proportion being some 15% for the questionnaire yards). Other work (including conversions and industrial activity) has been generally been around 20% of total activity in all the yards (apart from the exceptional years 1965 and 1966). The questionnaire yards accounted for a high proportion of this industrial activity, which thus bulks more heavily in their total activity (one-quarter to one-third). It might be noted that well over 75% of the industrial activity in the shipbuilding industry is carried out by two companies in the St. Lawrence region, using special facilities that are to a large extent separate from their shipbuilding and repairing operations.

In summary, the pattern of activity in recent years has been about as follows:

TABLE C-18

CANADA

THE IMPORTANCE OF FEDERAL GOVERNMENT
PROCUREMENT IN NEW CONSTRUCTION ACTIVITY

	All New Construction	New Construction for Federal Government			Federal Government as % of Total		
		Naval	Civilian	Total	Naval	Civilian	Total
	$ Million	$ Million	$ Million	$ Million	%	%	%
1969 Est.	$ 132.1	$ 21.2	$ 21.9	$ 43.1	16%	17%	33%
1968	141.4	24.4	30.3	54.7	17	21	38
1967	145.7	10.6	26.6	37.2	7	18	25
1966	111.8	1.9	39.0	40.9	2	35	37
1965	130.4	2.2	25.6	27.8	2	20	22
1964	92.2	9.8	12.6	22.4	11	14	25
1963	91.2	18.3	11.4	29.7	20	13	33
1962	98.8	29.5	13.8	43.3	30	14	44
1961	66.4	16.4	10.0	26.4	25	15	40
1960	61.0	9.1	10.9	20.0	15	18	33
1959	60.3	11.5	19.9	31.4	19	33	52
1958	63.6	20.3	9.2	29.5	32	14	46

Source: Questionnaire to Yards.

TABLE C-19

CANADA

NEW CONSTRUCTION ACTIVITY
(EXCLUDING GOVERNMENT PROCUREMENT)

	All New Construction $ Million	Dry Cargo $ Million	Tankers $ Million	Ferries $ Million	Fishing Vessels $ Million	Barges $ Million	Tugs $ Million	Other $ Million	Total Non-Gover $ Mill
1969 Est.	$ 132.1	$ 15.9	$ 20.5	$ 6.7	$ 6.2	$ 15.6	$ 10.0	$ 14.1	$ 89
1968	141.4	47.4	9.0	1.5	14.9	8.6	2.0	3.5	76
1967	145.7	48.7	1.8	8.4	38.7	8.0	0.7	2.3	108
1966	111.8	30.2	1.8	3.5	25.0	8.2	1.9	0.4	71
1965	130.4	77.6	4.6	2.0	8.7	7.3	2.5	0.2	102
1964	92.2	38.9	9.4	4.2	6.5	5.1	1.1	4.7	69
1963	91.2	29.7	11.8	1.8	7.1	6.6	2.3	2.6	61
1962	98.8	32.8	7.6	2.3	3.1	6.0	3.7	-	55
1961	66.4	26.9	4.4	4.7	0.3	3.4	-	-	39
1960	61.0	31.6	3.5	2.3	1.1	2.5	-	-	41
1959	60.3	15.0	10.0	1.9	-	1.6	0.3	-	28
1958	63.6	21.7	8.3	0.5	1.2	1.9	0.5	-	34

	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
1969 Est.	100%	12%	15%	5%	5%	12%	8%	10%	67%
1968	100	34	6	1	11	6	1	2	62
1967	100	33	1	6	27	5	-	2	75
1966	100	27	2	3	22	7	2	-	63
1965	100	60	3	2	7	6	1	-	78
1964	100	42	10	5	7	6	1	5	75
1963	100	33	13	2	8	7	3	3	67
1962	100	33	8	2	3	6	4	-	56
1961	100	41	7	7	-	5	-	-	60
1960	100	52	6	4	2	4	-	-	67
1959	100	25	17	3	-	3	-	-	48
1958	100	34	13	1	2	3	1	-	54

Source: Questionnaire to Yards.

Note: Total may not add due to rounding.

	New Construction	Repairs	Other Work
All yards	50 - 60%	20%	25%
Questionnaire yards	50 - 60%	15%	30%

Clearly, new construction has been the prime activity of the industry in Canada, and since the sources of demand for new construction are of paramount importance to the industry, they are examined next, in detail.

New Construction

Information has not hitherto been available on the composition of the industry's annual construction programme by type of vessel or source of work. D.B.S. publishes information on deliveries of only certain classes of vessels, and makes a work-in process adjustment only for total construction. Information on the size of specific government or non-government contracts is generally known in the trade, but their impact in summary form in terms of annual yard activity is not.

To improve on this situation, the questionnaire to yards asked specifically for new construction activity by type of work, and the summary of responses is shown in Tables C-18 and C-19. Even though the data do not include all smaller yards, nor the larger yards which ceased to operate before the end of 1969, they are still most useful for analyzing the varied structure of the work performed by the industry. It should be noted that the dollar values refer to value of work performed during individual years, and not to values of deliveries.

The great significance for the industry of Federal Government procurement programmes may be seen from Table C-18; over the whole period 1958-69 it averaged just over one-third of total new construction activity. Activity from naval demand sources tailed off in the mid 60's after completion of earlier programmes; recently it increased again with the helicopter destroyer and operational support ship contracts, though not to former levels and in a limited number of yards.

Procurement by civilian Federal Government departments has been fairly steady in relation to total activity (except for the years 1959 and 1966), but the effect of fluctuating naval requirements has been that total Federal Government procurement has ranged between $55 million and $20 million in individual years, and from 52% of new construction activity to 22%. Both the size and the variability in Government procurement has thus been significant for the industry's operations.

Table C-19 reveals that about another one-third of activity on the average in 1958-69 came from construction of dry cargo vessels. A peak occurred in 1965 with the announcement that subsidy would be reconsidered in 1966. Subsequently, dry cargo building continued at about its former relative level, although preliminary indications for 1969 are that a sharp fall-off occurred both in dollar and relative terms.

The remaining one-third or so of new construction activity has come from the other vessel types as a group. Tanker business for coastal and inland waters has been spotty; had it not

been for substantial tanker orders placed in 1968 and 1969 total new construction activity in the latter year would have been substantially lower. Ferries have been a fluctuating source of business that has been relatively small in the national total. Construction of fishing vessels expanded markedly in 1966 and 1967, but subsequent depressed conditions in the fishing industry and reduction in the rate of subsidy from 50% to 35% has lowered demand from that source. Barge business increased steadily in 1958-68 and then almost doubled in 1969. Tug business has been fairly steady until 1969, when it increased substantially in association with developments in barges. Some other types of vessels were recorded by yards in the category shown in the table as other, including work being done on off-shore drill rigs.

The Resources used in the Industry

Having examined the level and composition of the industry's output, it is desirable to turn to assessment of the economic resources that are used by the industry - the inputs that produce the end-products.

Such an assessment is made by examining resource use in the industry and comparing it with resource use in other industries. In doing this, however, it should be remembered that the shipbuilding and repair industry exhibits characteristics that differentiate it to a considerable extent from other manufacturing industries. (Indeed, the most comparable industry to shipbuilding is a non-manufacturing industry - construction -

but unfortunately data are not available for construction in a form that allows a useful comparison to be made). The main products of the shipbuilding industry have a high unit value and a long production period compared with the products from other industries. This can result in considerable instability in shipyard operations, depending on the flow of orders, and in sizeable fluctuations in employment. Within the industry, also, there are a variety of activities carried on in yards of different sizes in different regions of Canada - the building of a wide variety of type and size of ships, repairs, refits and conversion, and industrial work of different kinds.

Having noted that there are significant differences and individual characteristics in the industry, however, it is still possible and useful to examine the operations of the industry through its use of resources, and to make comparison with other industries in Canada.

Other industries, like shipbuilding, have characteristics that are unique, and they also engage in varied activities within and outside their main fields and have different sized operations in different regions.

The basic comparison that has been made is of the shipbuilding and ship repair industry with all manufacturing industries in Canada, with the purpose of assessing circumstances in this activity in relation to manufacturing activities as a whole. There are, of course, a wide variety of manufacturing activities

carried on, with differing production processes and resource use. In order to obtain a comparison more closely related to shipbuilding, certain other industries were selected from among a number examined and data were developed for them. These industries were:

- aircraft and parts
- boiler and plate works
- fabricated structural metal
- motor vehicles
- steel pipe and tube mills

The first three of these industries have some operations similar to those in shipbuilding - metal working, assembly and erection, and installation and fitting of electrical and other components. The other two industries - motor vehicles and steel pipe - also have features connected with metal working and assembly, but have been primarily chosen for contrast because their operations are assembly or flow processes carried out on a large scale. Although none of these industries is exactly similar to the shipbuilding industry, there are some common features and as a group they provide a basis for assessment.

It should be noted that the data used for the inter-industry comparisons are drawn from the Dominion Bureau of Statistics Annual Census of Manufactures. The treatment of inputs by D.B.S. is somewhat different from that which is customary in the shipbuilding industry, (1) but is commonly accepted as most suitable for the comparisons being made and is uniform for all industries even though each may have its own method of assessment.

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(1) DBS treats purchases of fuel and power as purchases of material, and includes all hourly paid labour in one total of production and related workers. The industry's practice in its internal assessments is to class fuel and power, and indirect labour, as overhead costs.

TABLE C-20

CANADA

PURCHASED MATERIALS AND UTILITIES,
WAGES OF PRODUCTION AND RELATED WORKERS,
OVERHEAD AND PROFIT, AS PERCENTAGES OF VALUE OF WORK PERFORMED

1966

	Purchases	Production Wages	Overhead and Profit
Shipbuilding and Repair	44%	30%	26%
All Manufacturing Industries	57	15	28
Aircraft and Parts	46	24	30
Boiler and Plate Works	46	24	30
Fabricated Structural Metal	48	22	30
Motor Vehicles	73	9	18
Steel Pipe and Tube Mills	71	11	18

Sources: D.B.S. Annual Census of Manufactures

Note: Value of work performed corresponds to value of shipments of goods of own manufacture.

Besides assessing shipbuilding in relation to other industries, it would have been desirable also to compare resource use in the shipbuilding industry in Canada with that in the industry in other countries. Unfortunately data are not available in comparable form, even in information brought together by the Organization for European Co-operation and Development which is active in assessing shipbuilding in its member countries. One exception is the United States for which information on industrial activity is accumulated in a similar manner to that in Canada; comparative data on the U.S. shipbuilding industry are thus presented at the end of this section.

All Resources

The first comparison made is of the use of all resources in the shipbuilding and repair industry compared with use in all manufacturing industries and in the selected individual industries. Table C-20 shows the proportions in total value of work performed that were made up by purchased materials and utilities, production and related wages, and overhead and profit in 1966. This year was chosen because it is the latest for which data are available for all industries as a group, but the relative position is not greatly different in earlier years.

Shipbuilding and repair uses substantially more labour in relation to work performed than any other industry with which a comparison is being made. It uses relatively twice as much labour as all manufacturing and over three times as much as the motor vehicle industry. Production wages in shipbuilding and repair are

54% of value added (value of work performed less purchases of materials and utilities) compared with proportions of less than 45% for the other industries in the table; this indicates the labour intensive nature of the industry.

The shipbuilding and repair industry is one of a number of industries that use a less than average amount of material in relation to work performed.

Overhead and profit data show shipbuilding and repair to have margins similar to those of all manufacturing industries but lower than in several other industries such as aircraft, boilers and plate works and fabricated structural metal. However, the margins in the industry are over one-third higher than those in the motor vehicle and steel pipe industries.

These variations in resource usage indicate the principal ways in which operations in the shipbuilding and repair industry differ from those of other industries, although other factors, including technology and demand, must also be borne in mind when interpreting the data of Table C-20. For instance, the assembly line technique and high sales volume of the motor vehicle industry account for its high material usage and low overhead and profit margins.

Use of Capital

The sections that immediately follow discuss capital, labour and other overhead utilizations. Comparisons have been made between the shipbuilding and repair industry and other industries, showing their use of these particular resources in relation to value added, which is defined -- broadly speaking -- as total output less

TABLE C-21

CANADA

NEW CAPITAL EXPENDITURES

	Expenditures per $ of Value Added		Expenditures per Production and related Worker	
	All Manufacturing cents	Shipbuilding and Repair cents	All Manufacturing dollars	Shipbuilding and Repair dollars
1966	17.8¢	4.6¢	$2,484	$472
1965	15.4	4.9	2,097	498
1964	13.5	7.7	1,731	752
1963	11.1	4.3	1,353	357
1962	11.1	6.3	1,304	456
1961	10.4	8.4	1,155	601
1960	11.2	7.8	1,195	602
1959	11.1	3.6	1,148	271
1958	11.1	5.2	1,118	361

Sources: 1 - D.B.S. Annual Census of Manufactures
2 - D.B.S. Public and Private Investment and Business Finance Division

CAPITAL ASSETS

	Gross Book Value of Assets Per Production & Related Worker		Net Book Value of Assets Per Production & Related Worke	
	All Manufacturing Buildings and Equipment* dollars	Shipbuilding and Repair Land, Buildings and Equipment dollars	All Manufacturing Buildings and Equipment * dollars	Shipbuilding and Repair Land, Buildin and Equipmen dollars
1966	$ 29,860	$ 9,480	$ 18,250	$ 3,560
1965	28,270	9,250	17,200	3,560
1964	26,650	10,900	16,180	4,200
1963	25,600	9,050	15,540	3,240
1962	24,640	8,250	15,000	2,950
1961	24,000	10,250	14,720	3,610
1960	21,660	8,920	13,400	2,980
1959	20,010	9,200	12,490	2,970
1958	19,210	7,320	12,050	2,380

Sources: 1 - D.B.S. Annual Census of Manufactures
2 - D.B.S. Fixed Capital, Flows and Mid-Year Stocks
3 - Shipyard Questionnaires
* Not Including Land.

TABLE C-26

CANADA

OVERHEAD AND PROFIT AS PERCENT OF VALUE OF WORK PERFORMED IN SELECTED INDUSTRIES, AND CERTAIN ELEMENTS IN THE TOTALS

1966

	Total Overhead and Profit	Administrative, Office, Sales, and Distribution Salaries	Fringe Benefits, Hourly and Salaried Staff	Residual, after overhead salaries & all Fringe Benefit
Shipbuilding & Repair	25.9%	6.7%	7.1%	12.1%
All Manufacturing	27.8	8.4	4.4	15.0
Aircraft & Parts	29.9	15.4	7.3	7.2
Boiler & Plate	29.4	9.6	6.4	13.5
Fabricated Structural Metal	29.9	8.1	5.7	16.1
Motor Vehicles	17.9	4.8	2.7	10.4
Steel Pipe & Tube	17.8	4.1	2.9	10.8

Sources: D.B.S. Annual Census of Manufactures

D.B.S./Department of Labour. Survey of Labour Costs in Manufacturing, 1967.

materials and utilities; in other words, value added is a measure of activity within the industry itself. Use of value added data is appropriate for this comparative analysis since it enables comparisons of productivity to be made between industries. It shows only the additional output produced by labour, capital and management in an industry, quite separately from the productivity in the industries that supply materials and utilities.

Regarding capital utilization, Table C-21 gives information on annual new capital expenditures and on capital assets in all manufacturing industries as a group and in shipbuilding and repair. In order to assess relative levels of spending, capital expenditure has been expressed in relation to value added and the number of workers, while recognizing that decisions to undertake investment are made on the basis of many influences. Assessment of spending ratios for individual years should recognize that capital expenditures are made over a period of time while value added and work forces can fluctuate substantially over shorter periods.

In every year since 1958, shipbuilding and repair has spent less on capital items, both in relation to value added and its work force, than all manufacturing industries. The industry's expenditure in the early 1960's was higher than in the late 1950's but since then it has declined. Capital expenditures in all manufacturing industries were roughly stable until 1964 when they rose markedly. Information for 1967-69 is incomplete. However, it

indicates that relative capital spending by all manufacturing industries stabilized at a somewhat lower level than in 1964-66, but that capital investment by the shipbuilding industry continued to decline in relation to value added.

The evidence suggests, therefore, that the shipbuilding and repair industry has generally invested proportionately less in years since 1958 than has manufacturing as a whole, but there is an important qualification to the above conclusion. The shipbuilding and repair industry spends more on repairs (plant maintenance) in relation to new capital expenditure than does all manufacturing industries (D.B.S. data differentiates between those expenditures which are capitalized and hence are called capital expenditures and those which are charged to operations and are called repair expenditures). Thus, new capital expenditures are those which add to or replace existing facilities while repair expenditures are those which maintain existing facilities in good order.

The table below shows expenditure on repairs (plant maintenance) as a percentage of new capital expenditure from 1958-69 for the industry and for all manufacturing industries. In most years since 1958, the industry's repair expenditure has exceeded 80% of its new capital expenditure. In three years it spent considerably more on repairs than new capital items. By contrast, all manufacturing industries' repair expenditure was generally about half of its new capital expenditure.

Canada

	Expenditure on Repairs as a % of New Capital Expenditure	
	All Manufacturing	Shipbuilding & Repair
1969 (est.)	47	96
1968 "	52	82
1967	46	153
1966	38	85
1965	42	80
1964	49	50
1963	59	98
1962	59	70
1961	63	62
1960	57	70
1959	58	167
1958	52	114

Source: DBS Public and Private Investment and Business Finance Division

This greater expenditure on repairs reflects the nature of the assets and the activity in the shipbuilding industry. The basic "plant" - including wharfs, dry docks, graving docks, and launchways - has a long life but requires a continuing high level of maintenance expenditures. The cost of dredging, and of jigs, tools and dies for individual contracts, are charged to maintenance operations.

Other comparisons can be drawn from the data on capital per worker in the lower half of Table C-21. DBS reports information on the gross (acquisition cost) and on the net (gross less capital cost allowances) investment in buildings and equipment for all manufacturing industries. (This is described in the table as gross and net book value of assets.) Unfortunately, similar information is not available

from DBS for the shipbuilding and repair industry, but questionnaire yards supplied information on their book and net values of investment in land, buildings and equipment. Production man-hour data from the yards was converted to worker equivalents at 2,000 man-hours per year.

The gross book value of assets per worker in all manufacturing in 1958-66 has been at a higher level, and has increased faster over the period (55% versus 30%) than the gross book value per worker in shipbuilding and repairing. Consequently, whereas the gross book value per worker in shipbuilding was just below 40% of the gross book value in all manufacturing in 1958, this proportion had declined to under one-third in 1966. Data from the yards for 1967-69 indicate some substantial capital expenditures in those years but these would not significantly change the longer term situation vis-à-vis all manufacturing.

It appears also that the age of the major capital assets being used in the shipbuilding industry is greater than in manufacturing generally. Thus the proportion of net to gross book values of capital per worker in 1958-66 for the industry was between 32% and 40%; the same ratio for all manufacturing industries was consistently over 60%.

Again, then, the inferences from the data support the conclusion that the shipbuilding and repair industry is notably less capital intensive (and thus more labour intensive) than Canadian manufacturing industries as a whole.

TABLE C-23

CANADA

AVERAGE WAGES PER MAN-HOUR PAID,
PRODUCTION AND RELATED WORKERS

1961 - 67
dollars

	1961	1962	1963	1964	1965	1966	1967	Per Cent Increase 1961 - 67
Shipbuilding & Repair	$ 2.04	$ 2.14	$ 2.22	$ 2.35	$ 2.43	$ 2.55	$ 2.74	34%
All Manufacturing	1.78	1.85	1.92	1.99	2.10	2.23		25*
Aircraft & Parts	2.13	2.16	2.24	2.36	2.45	2.63	2.91	37
Boiler & Plate	1.93	2.05	2.03	2.20	2.35	2.74	2.90	50
Fabricated Structural Metal	2.37	2.41	2.47	2.61	2.69	2.92	3.04	28
Motor Vehicles	2.36	2.53	2.69	2.75	3.00	3.09	3.19	35
Steel Pipe and Tube	2.40	2.45	2.58	2.58	2.67	2.85	2.95	23

Sources: D.B.S. Annual Census of Manufactures

Note: The 25% growth for All Manufacturing is for 1961-66. The growth for the same period for Shipbuilding and Repair was 25%.

TABLE C-22

CANADA

VALUE ADDED PER DOLLAR OF LABOUR COST

1961 - 67
dollars

	1961	1962	1963	1964	1965	1966	1967
Shipbuilding & Repair	$1.74	$1.53	$1.70	$1.95	$1.96	$1.85	$1.74
All Manufacturing	2.95	2.98	3.00	3.00	2.98	2.93	
Aircraft & Parts	2.15	2.28	2.35	2.32	2.42	2.31	2.34
Boiler & Plate	2.45	2.50	2.07	2.38	2.45	2.23	2.61
Fabricated Structural Metal	2.01	2.26	2.29	2.32	2.52	2.36	2.30
Motor Vehicles	3.25	3.49	3.67	3.20	3.05	3.02	3.74
Steel Pipe & Tube	3.44	2.53	2.63	2.87	2.69	2.69	2.35

Source: D.B.S. Annual Census of Manufactures

Use of Labour

The relatively greater use of labour in the shipbuilding industry than in other fields of manufacturing activity prompts examination of measurements relating to labour output and costs. This is further justified by the close attention given by the industry itself to labour-related measures of performance, in recognition of labour being a prime variable and also a major controllable element in yard costs. DBS began compiling its industry statistics in a way that makes such detailed analyses possible only from 1961 on. Hence 1961 is the base year for these data. Table C-22 shows value added -- i.e. shipments less materials and utilities purchased -- in relation to labour costs. As would be expected in a labour intensive industry, the value added per dollar of labour cost was below the average for all manufacturing and below the values for the selected industries during the period. Value added per dollar of labour cost has changed from one year to the next as a result of several factors, including hourly wage rates, productivity, the price of the finished product and the level of activity in the industry, but on the whole has been at about the same level over the period.

Table C-23 shows that wages paid per man-hour of production and related workers in shipbuilding and repair are above average for all manufacturing, reflecting in part the higher than average degree of skill required in the industry. Wages in the other industries which were selected for comparison because of some comparability to shipbuilding,

TABLE C-25

CANADA

VALUE ADDED IN CONSTANT 1961 DOLLARS PER MAN-HOUR PAID FOR PRODUCTION AND RELATED WORKERS

1961 - 67
dollars

	1961	1962	1963	1964	1965	1966	1967	Per Cent Increase 1961-67
Shipbuilding & Repair	$3.55	$3.44	$3.95	$4.54	$4.74	$5.19	$5.03	42%
All Manufacturing	5.30	5.57	5.76	5.95	6.17	6.32		19*
Aircraft & Parts	4.58	4.72	4.87	5.02	5.18	5.02	5.63	23
Boiler & Plate	4.71	4.61	4.24	4.57	4.53	4.65	5.25	12
Fabricated Structural Metal	4.77	5.17	5.04	5.65	5.73	6.24	5.56	17
Motor Vehicles *	7.23	8.09	8.87	8.71	8.94	9.79	10.46	45
Steel Pipe and Tube	8.26	6.13	6.90	7.65	7.45	7.28	7.66	(8)

Sources: D.B.S. Annual Census of Manufactures

D.B.S. Indexes of Real Domestic Product by Industry

Note: 1 - The 19% growth for All Manufacturing is for 1961-66. The growth for the same period for Shipbuilding and Repair was 46%.

2 - For these data, the Motor Vehicle industry and the Truck Body and Trailer industry are combined.

3 - The procedure adopted was to apply D.B.S. indexes of Real Domestic Product by industry to 1961 value added dollars, and to divide the resulting dollar series (of value added in constant dollars), by manhours for production and related workers.

TABLE C-24

CANADA

VALUE ADDED IN CURRENT DOLLARS PER MAN-HOUR FOR PRODUCTION AND RELATED WORKERS

1961 - 67
dollars

	1961	1962	1963	1964	1965	1966	1967	Per Cent Increase 1961 - 67
Shipbuilding & Repair	$ 3.55	$ 3.27	$ 3.78	$ 4.58	$ 4.75	$ 4.70	$ 4.77	34%
All Manufacturing	5.30	5.52	5.74	5.98	6.26	6.55		24%
Aircraft & Parts	4.58	4.94	5.26	5.69	5.92	6.08	6.82	49%
Boiler & Plate	4.71	5.12	4.20	5.25	5.75	6.11	7.57	61%
Fabricated Structural Metal	4.77	5.45	5.65	6.05	6.77	6.90	6.98	46%
Motor Vehicles	7.69	8.83	9.69	8.78	9.14	9.29	13.59	77%
Steel Pipe and Tube	8.26	6.18	6.79	7.40	7.20	7.66	6.92	(16%)

Sources: D.B.S. Annual Census of Manufactures

The 24% growth for All Manufacturing is for 1961-66. The growth for the same period for Shipbuilding and Repair was 32%.

however, are generally somewhat higher than in shipbuilding and repair. The rate of increase in wages per man-hour from 1961-66 has been much the same in shipbuilding and repair as in all manufacturing industries, being faster than in some individual industries and slower than in others.

Since shipbuilding wages have risen over the period, while value added per dollar of labour cost (Table C-22) has been maintained, there evidently has been an increase in output per man-hour; the data relating to this are given in Table C-24. Value added in current dollars per man-hour in shipbuilding and repair rose 32% from 1961-66 compared with 24% for all manufacturing. The specific industries selected for comparison exhibited substantially greater gains with the exception of the steel pipe and tube industry, which recorded a decline from the unusually high level of 1961.

However, analysis of the same data in constant dollar terms (Table C-25) shows that the shipbuilding and repair industry's productivity has advanced in real terms faster than that in other industries. Volume of output per man-hour in shipbuilding and repair increased more than twice as fast as in all manufacturing for 1961-66 and in 1966 and 1967 was beginning to approach the level of the aircraft, boiler and plate works, and fabricated metal industries. The data implies that from 1961-67 shipbuilding and repair prices have declined in relative terms while those of most other industries have risen. Thus part of the industry's improved productivity has evidently been passed on to ship owners.

The measures of volume of output in Table C-25 are not precise since they are composed of value series that are deflated by somewhat crude price indexes or by deflated cost series, and the result cannot fully reflect the complex nature of many industries, e.g. the shipbuilding and repair industry. Despite these reservations, however, such measurements are useful at least in broad terms in indicating the performance of an industry apart from the effects of changing price levels.

Many factors underlie the increase in productivity in the industry including capital investments and adoption of new methods and procedures which are referred to in the section on yard facilities and methods. Besides these, however, it is highly likely that the greatly increased scale of operation that became possible for the industry in the 1960's was a most significant factor in the rise in its productivity. This has implications not only in this assessment of past operating characteristics, but also in relation to the prospects for the industry in the future.

Use of Other Resources

Table C-20 demonstrated that the category of resources called "overhead and profit" represented the following proportions of value of shipments in 1966 for different industries:

Shipbuilding and Repair	26%
All Manufacturing	28
Aircraft and Parts	30
Boiler and Plate Works	30
Fabricated Structural Metal	30
Motor Vehicles	18
Steel Pipe and Tube Mills	18

Many elements are included in the payments for resources in this category under the DBS definitions (which differs from the industry's practice in its internal assessments) such as the following:

- salary payments to administrative, office, sales and distribution staff
- fringe benefits for wage and salaried personnel
- purchase of corporate services like advertising, auditing, legal counsel, etc.
- financing and depreciation charges related to use of capital
- local, provincial and federal taxes
- profits earned on capital as a "normal" return or as a reward for innovation or risk.

In this section, comments are made on these elements to the extent that the data available allow.

Regarding salaries for administrative, office, sales and distribution staff, information is available for the industries being examined and has been shown as a percent of value of shipments in Table C-26.

Such overhead salaries are a lesser proportion of shipments in the shipbuilding and repair industry than in all manufacturing. This arises both from lower average salaries being paid to such personnel ($6,225 in the industry compared with $6,600 in all manufacturing in 1966) and lesser use of salaried staff in the industry per dollar of sales. The somewhat more capital intensive industries being examined have a generally higher proportion of overhead salaries, notably the aircraft and parts industry.

Assembly or process industries like motor vehicles and steel pipe and tube mills have a low proportion of overhead salaries in relation to sales by virtue of their high throughput.

For fringe benefits, information from questionnaire yards was that such benefits in the shipbuilding industry were generally of the order of 20% of wage costs. This corresponds closely to the average of 19% for fringe benefits (1) in relation to wages and salaries in manufacturing which was reported for 1967 in a joint DBS/Department of Labour Survey. This average level of 19% has been applied to all wages and salaries in the industries being examined, and the fringe benefits thus calculated have, in turn, been expressed per dollar of sales.

The result is shown in the third column of Table C-26, and indicates that the labour intensive character of shipbuilding brings with it a considerably higher level of fringe benefits in relation to sales than in manufacturing generally. Only one of the selected industries has a higher level of fringe benefits -- aircraft and parts, probably because of its high component of salaried staff.

Deducting from the overhead and profit margins in Table C-26 the salary and fringe benefit costs that have been identified, the residual contains payments for certain purchased services, financing and depreciation charges, taxes, and profits earned on capital.

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(1) Including holiday pay, vacation pay, sick leave, workmen's compensation, unemployment insurance, Canada/Quebec pension plan, private pension, life and health plans, and certain other miscellaneous payments.

It is not possible to examine separately these remaining components and, in such a situation, the practice is often adopted of proceeding directly to an assessment of comparative profitability as measured by different profitability ratios. DBS, through the Corporation and Labour Unions Returns Act administration, provides information on profitability for industry groups which correspond closely to the group classifications used in other DBS statistics. Unfortunately, such information is available for only three years on a consistent basis and, for shipbuilding and repair, the last of these years (1967) includes major losses for one company which have a substantial effect on the industry statistics. Thus, the ratio of profit before taxes to shareholders equity for the industry as reported by CALURA, declined from 17.7% in 1965 to 10.4% in 1966 and 3.4% in 1967.

The shortness of the time period and the special circumstances in 1967 make it impossible, in a "normal" sense to assess profitability in the industry in comparison with other industries or with manufacturing industries as a whole. The residual percentage shown in the last column of Table C-26 cannot thus be analyzed further with meaningful results.

Use of Resources by Type of Activity

Further perspective on use of resources by the shipbuilding and repair industry is available from information provided by questionnaire yards on costs in new construction, repairs, industrial and conversion work. Yards were asked for this information for four selected years: 1958, which predated the opening

TABLE C-27

CANADA

RELATIVE USE OF RESOURCES BY TYPE OF ACTIVITY
IN THE SHIPBUILDING AND REPAIR INDUSTRY

	New Construction				Repairs			
	Est. 1969	1967	1963	1958	Est. 1969	1967	1963	1958
Importance of Activity in Total Activity	56%	62%	57%	54%	14%	14%	14%	17%
Use of Resources within the Activity:								
Materials	53%	62%	52%	50%	24%	27%	23%	26%
Labour	28	27	27	29	36	36	37	34
Overhead & Profit	19	11	21	21	40	37	40	40
TOTAL	100	100	100	100	100	100	100	100

	Industrial				Conversion			
	Est. 1969	1967	1963	1958	Est. 1969	1967	1963	1958
Importance of Activity in Total Activity	26%	21%	24%	25%	4%	3%	5%	4%
Use of Resources within the Activity:								
Materials	47%	49%	43%	43%	42%	38%	26%	43%
Labour	21	18	22	17	35	37	43	32
Overhead & Profit	32	33	35	40	23	25	31	25
TOTAL	100	100	100	100	100	100	100	100

Source: Questionnaires to Yards

of the Seaway and the introduction of subsidies; 1963, which was a year of good activity after the effect of subsidy had been experienced; 1967, which was the first year under the revised subsidy arrangements; and the most recent year, 1969, on an estimated basis.

These data are for questionnaire yards only, and hence relate to a different group of yards than the DBS data presented earlier. Also, in accordance with yard practice, utilities and indirect labour are included in overhead and this is a different treatment from the earlier DBS data. However, the questionnaire responses provide a valuable insight into the operating conditions in the industry. To begin with, the following records the summary picture for all activity by the questionnaire yards in Canada:

Per Cent of Value of Work Performed made up by:	1969 Est.	1967	1963	1958
Materials	47%	53%	45%	44%
Production Labour	28	26	28	27
Overhead & Profit	25	21	27	29
Total	100%	100%	100%	100%

Setting aside the abnormal data for 1967 (which were affected by losses incurred by a yard that has since ceased building), materials have represented about 45% of the value of activity, and production labour, and overhead and profit, each about 27½%.

As Table C-27 shows, these averages are made up of varying cost patterns in the different types of industry activity. For new construction, in which labour has been about 27½% of the

value of work, the importance of materials has exceeded 50% and of overhead and profit has been of the order of 20%. These data indicate that in new construction, (which is the mainstay of the industry's activity), the margin for overhead and profit has been substantially less than in all of the industry's activities and than in many of the other manufacturing industries with which comparisons are being made (aircraft and parts, boiler and plate, fabricated structural metal: see Table C-26).

The data appear to indicate, therefore, the presence of very active competition among yards for the new construction business that is available, and a willingness to contract for new construction work at lower-than-industry margins in order to obtain work for the yard which will provide a basis for other, more profitable operations.

On repair work, material input is less and labour input greater than on new construction. This is reflected in the percentage for overhead and profit which is of the order of 40%, the highest experienced in the types of activity carried on by the industry.

On industrial work, the material, labour and overhead and profit percentages are very similar to those in the other types of industry that are being used for comparative purposes (Table C-20), as would be expected if industrial work in shipyards is to be competitive with that done elsewhere. In interpreting these data, however, it should be borne in mind that well over three-quarters of

TABLE C-28

CANADA

SHIPBUILDING AND SHIP REPAIR

COMPARATIVE ECONOMIC DATA FOR DIFFERENT-SIZED YARDS

1967

	Establishments with Value of Work Performed			
	$500,000 -999,999	$1,000,000 -4,999,999	Over $5 Million	All Establishments
Number of Establishments	13	21	12	74
Work Performed as per cent of Total Industry Work Performed	4%	12%	82%	100
Per Cent of value of Work Performed made up by:				
Materials & Utilities	33%	41%	48%	46%
Production Wages	37	32	30	31
Overhead & Profit	30	27	22	23
Value added per $/wages	$1.85	$1.84	$1.71	$1.74
Value added per production man-hour	$4.60	$4.67	$4.81	$4.77
Average wage cost per production man-hour	$2.64	$2.53	$2.81	$2.73

Source: DBS Annual Survey of Manufactures

Note: Value of work performed corresponds to value of shipments of goods of own manufactures, as officially reported.

the industrial work done by the shipbuilding industry in Canada is carried out by a few large establishments in facilities that are to a large extent separate from shipbuilding operations. Industrial work in other yards is on a much more restricted scale.

Conversion work, which is relatively small in total, falls between new construction and repair work in its use of resources. There is no pattern in the content of conversion work, which depends on the nature of the job to be carried out.

In summary, within the overall activity of shipbuilding yards, it would appear that overhead and profit margins are low on the new construction work which is the principal activity in the industry, relatively higher on repairs, and normal in industrial work for that type of work.

Effect of Size of Yards on Use of Resources

The foregoing analysis has been for the shipbuilding and repair industry as a whole, including the large, medium and small yards. A question arises as to the effect of variations in the level of performance in different sized yards and the desirability that the analysis should proceed beyond industry averages for this reason.

Table C-28 has been set up to examine this point. It shows for 1967 the relative importance of yards by three broad size classes (leaving out those with less than $500,000 of sales) and displays also some of the broad assessment measures developed earlier.

It will be noted that the twelve establishments with sales of over $5 million accounted for over 80% of total industry sales in 1967. Because of their weight in the averages, the assessment

ratios for these twelve establishments are not far from those of the industry as a whole. The general effect of larger yards in 1967 were:

- a relative increase in purchased materials (probably associated with a relatively greater involvement in new construction)
- a relative reduction in labour utilization
- a reduced percentage for overhead and profit
- generally higher labour rates
- a reduction in value added per wage dollar
- increased output per man-hour

But on the whole, the variations in resource use and performance are relatively small and industry averages are thus considered to be significant and meaningful for general analytical purposes.

Comparison of the Canadian and U.S. Shipbuilding Industries

As was mentioned above, data on the U.S. industry alone are available in a form comparable generally to that for Canada. Consequently, it is the only country with which direct comparisons can be made. Certain definitional differences between the U.S. and Canada are not serious enough to invalidate the comparison. It should be noted that all U.S. data are shown in U.S. dollars and all Canadian data in Canadian dollars; the Canadian devaluation in 1962 would affect the conversion between the two currencies and in any event trends in performance rather than absolute values are being assessed. The following brief review does not purport to be an exhaustive analysis of the relative positions of the two shipbuilding industries.

TABLE C-32

CANADA AND U.S.A.

SHIPBUILDING AND SHIPREPAIRING INDUSTRIES

1961 - 1966

	Value added per dollar of labour cost for production and related workers		Average wages per man-hour paid for production and related workers	
	Canada Canadian $	U.S.A. U.S. $	Canada Canadian $	U.S.A. U.S. $
1966	1.85	1.66	2.55	3.46
1965	1.96	1.63	2.43	3.31
1964	1.95	1.67	2.35	3.21
1963	1.70	1.66	2.22	3.15
1962	1.53	1.65	2.14	3.10
1961	1.74	1.62	2.04	3.03
Per Cent Change 1961-66			25%	14%

	Value added per man-hour paid for production and related workers in current dollars		Value added per man-hour paid for production and related workers in constant dollars and as an index		
	Canada Canadian $	U.S.A. U.S. $	Canada 1961 Canadian $	Canada Index	U.S.A. 1958 U.S.$
1966	4.70	5.75	5.19	146.2	5.52
1965	4.75	5.40	4.75	133.8	5.28
1964	4.58	5.37	4.54	125.1	5.31
1963	3.78	5.22	3.95	111.3	5.39
1962	3.27	5.12	3.44	96.9	5.19
1961	3.55	4.90	3.55	100.0	4.82
Per Cent Change 1961-1966	32%	17%		46.2%	

Sources: D.B.S. Annual Census of Manufactures
U.S. Bureau of Census: Annual Survey of Manufactures

Notes: For Canadian data the procedure adopted was to apply the D.B.S. index of Real Domestic Product for the shipbuilding and repair industry to 1961 value added dollars, and to divide the resulting dollar series (of value added in constant dollars) by man-hours for production and related workers.

For U.S. data the procedure adopted was to apply the U.S. Department of Commerce implicit price deflator for ships and boats to the current value added dollar figure for each year, and to divide the resulting dollar series (of value added in constant 1958 dollars) by man-hours for production and related workers.

TABLE C-31

CANADA AND U.S.A.

SHIPBUILDING AND SHIPREPAIRING INDUSTRIES

NEW CAPITAL EXPENDITURES

1961 - 1966

	Expenditure per $ of value added		Expenditure per production and related worker	
	Canada	U.S.	Canada	U.S.
	Canadian cents	U.S. cents	Canadian $	U.S. dollars
1966	4.6c.	3.9c.	$472	$462
1965	4.9	3.7	498	407
1964	7.7	3.1	752	338
1963	4.3	2.4	357	254
1962	6.3	2.4	456	245
1961	8.4	3.4	601	331

Sources: D.B.S. Annual Census of Manufactures
D.B.S. Public and Private Investment and Business Finance Division
U.S. Bureau of Census: Annual Survey of Manufactures

TABLE C-30

CANADA AND U.S.A.

SHIPBUILDING AND SHIPREPAIRING INDUSTRIES

PURCHASED MATERIALS AND UTILITIES, WAGES OF PRODUCTION AND RELATED WORKERS, OVERHEAD AND PROFIT AS PERCENTAGES OF VALUE OF WORK PERFORMED

1966

	CANADA	U.S.
Purchases	44%	42%
Production Wages	30	35
Overhead and Profit	26	23
Total	100%	100%

Sources: D.B.S. Annual Census of Manufactures
U.S. Bureau of Census Annual Survey of Manufactures

Note: Value of work performed corresponds to value of shipments of goods of own manufacture.

TABLE C-29

CANADA AND U.S.A.

SHIPBUILDING AND SHIPREPAIRING INDUSTRIES

1961 - 1966

Value of Work Performed

	Canada	U.S.
	Canadian $ million	U.S. $ million
1966	294	2339
1965	275	2078
1964	234	1826
1963	209	1680
1962	172	1670
1961	138	1621
Per cent increases:		
1961-66	113%	44%

Sources: D.B.S. Annual Census of Manufacturers

U.S. Bureau of Census: Annual Survey of Manufactures

Note: 1. Value of work performed corresponds to value of shipments of goods of own manufacture.

2. Both the Canadian and U.S. data refer to commercial shipyards and do not include naval yards.

To illustrate, first, the relative growth of the two industries, their total values of work performed have been shown in Table C-29. The rate of growth of the Canadian industry has been much faster over the period, 113%, compared with 44% for the U.S. commercial industry.

Table C-30 shows the proportions in total value of work performed made up by purchased materials and utilities, production and related wages, and overhead and profit in 1966 in the shipbuilding and repair industries of both countries, this being the latest year for which U.S. data are available. Purchased material is higher in Canada but labour is higher in the U.S., indicating that the industry is even more labour intensive than in Canada. Overhead and profit was somewhat higher in the Canadian industry in 1966 than in the U.S.

Table C-31 presents information on annual new capital expenditures in relation to value added and the number of workers in both the Canadian and U.S. industries. The U.S. shipbuilding industry is seen to have invested relatively less in capital items than the Canadian industry.

The same indicators have been used with respect to labour in the U.S. shipbuilding and repair industry as were used earlier for the Canadian industry. Table C-32 shows value added per dollar of labour cost, average wages per man-hour and value added per man-hour. Value added per dollar of labour cost has been very similar in both industries and has been maintained at roughly the same level throughout 1961-66. However, over the same period wages per man-hour

in the Canadian industry have risen much faster (25% compared with 14%). But output per man has also risen faster in Canadian shipbuilding: growth of value added in current dollars per man-hour from 1961-66 was 32% for the Canadian shipbuilding and repair industry compared with 17% for the U.S. industry. Despite this, the absolute level of value added per man-hour was higher in 1966 in the U.S. industry than in Canada, as measured in current dollars, though the gap has tended to narrow. Translating the data into constant dollars by the methods described in the footnote to the Table, it appears that the volume of output per man-hour in Canada has increased considerably faster in 1961-66 than in the U.S. (46% compared with 14.5%).

In summary, output, investment, wage rates and productivity have all increased at a considerably faster rate in the Canadian than in the United States shipbuilding and repair industry in 1961-66.

Canadian Shipyard Facilities and Methods

Introduction

Recent years have seen major changes in the facilities and methods used to build ships.

In several countries, very large shipyards have been established that specialize in the production of bulk carriers and tankers in excess of 200,000 DWT, and that use assembly line and automated techniques to the greatest extent possible.

Accompanying this very significant development has been the adoption of new methods and practices in existing yards for the building of ships of a great variety of types. These methods and practices usually constitute an adaptation of the techniques being used in the very large yards to the extent that they are applicable to the scale of operations and the production flexibility that is necessary for such smaller yards.

Shipbuilding yards in Canada fall into the latter category. The mix of vessels they have produced, the limited market open to them, and the fluctuations in their activity which have occurred, have all had an effect on the technical and management practices in Canadian yards.

In order to obtain an assessment regarding this, the Committee decided that visits be made, and questionnaires be sent to a representative number of Canadian yards with the purpose of:

- establishing the building facilities and technical methods and practices now being used in the Canadian industry.
- assessing the potential for introduction of new technology in light of practices elsewhere and of the prospects for Canadian yards in terms of the tonnages and ship types that have been projected.

The Dominion Bureau of Statistics classified 74 establishments to the shipbuilding and ship repair industry in 1967. Three other establishments not listed by D.B.S. do building or repair work. Seven establishments listed in 1967 have closed. Thus the present composition of establishments by type and by size as defined below is as follows:

TABLE C-33

CLASSIFICATION OF YARDS THAT ANSWERED THE QUESTIONNAIRE AND/OR WERE VISITED

CLASS CODE	YARD	REPLIED TO QUESTIONNAIRE	VISITED
(M)	MAJOR SHIPBUILDING YARDS (With average employment over 850 during period 1958-69)		
	Burrard Dry Dock Co. Ltd.	X	X
	Davie Shipbuilding Ltd.	X	X
	Hawker Siddeley Canada Ltd. (Halifax Shipyards Division)	X	X
	Marine Industries Ltd.	X	X
	Saint John Shipbuilding & Dry Dock Co. Ltd.	X	X
(I)	INTERMEDIATE SHIPBUILDING YARDS (With average employment between 450 and 850 during period 1958-69)		
	Canadian Shipbuilding & Engineering Ltd. (Collingwood Shipyards Division)	X	X
	Port Weller Dry Docks Ltd.	X	X
	Yarrows Limited	X	X
(S)	SMALL SHIPBUILDING YARDS (With average employment under 450 during period 1958-69)		
	Allied Shipbuilders Ltd.	X	X
	B.C. Marine Shipbuilders Ltd.	X	X
	Bel-Aire Shipyards Ltd.	X	X
	Ferguson Industries Ltd.	X	X
	Hike Metal Products Limited	X	X
	Manly, John, Ltd.	-	X
	McKay-Cormack Ltd.	X	X
	McKenzie Barge & Derrick Co. Ltd.	X	-
	Passpebiac	X	-
	Star Shipyard (Mercers) Ltd.	X	X
	The Fishermen's Loan Board of P.E.I.	X	X
	Vancouver Shipyards Co. Ltd.	X	X
(B)	BOAT BUILDING YARDS		
	Atlantic Shipbuilding Company Ltd.	X	X
	Chantier Naval Ltée.	X	X
(R)	SHIP REPAIR YARDS		
	Canadian National Newfoundland Dockyards	-	X
	Canadian Naval Dockyard (Esquimalt)	-	X
	Canadian Shipbuilding & Engineering Ltd. (Port Arthur Shipbuilding Co. Division)	X	X
	Canadian Vickers Ltd.	X	X

Major Yards	- 5
Intermediate Yards	- 3
Small Yards	- 13
Wood Boatbuilding Yards	- 17
Ship Repair Establishments	- 32

The criterion used to determine which shipyards and boatbuilding establishments would be requested to fill in questionnaires and be visited, was based on the receipt of subsidy payments of $100,000 or more annually during 1966-68, with some slight modification in order to obtain a reasonable cross section of the industry in each region.

Visits were made to 24 yards and questionnaire replies were received from 23 of the 24 that were asked to supply this information. Evaluation of the information in relation to methods and practices being used in other countries was based on information for foreign yards obtained from the publications in the bibliography.

Since the facilities and methods used by yards in Canada vary with the size and variety of vessels being built, it is desirable to adopt a classification system for yards. Several bases for classification are possible; the one chosen was based on employment, as follows: major yards - average employment in 1958-69 exceeding 850; intermediate yards - average employment in 1958-69 between 450 and 850; small yards - average employment in 1958-69 of less than 450. Table C-33 lists the classification and names of the yards visited and those that replied to the questionnaire. It might be noted that two of the yards classed as intermediate on the basis of employment are capable of building ships up to 730 feet in length.

TABLE C-34

SHIPBUILDING AND SHIPREPAIRING FACILITIES

QUESTIONNAIRE YARDS

SEPTEMBER 1969

NAME OF YARD	CLASS CODE	LOCATION	SIZE OF LARGEST VESSEL THAT CAN BE BUILT IN ONE PIECE (FEET)	BUILDING BERTHS		MARINE RAILWAYS		ELEVATOR TYPE DOCKS		FLOATING DOCKS		GRAVING DOCKS		CRANES			
														BUILDING BERTH		OUTFITTING WHARF	
				NO.	SIZE OF LARGEST (FEET)	NO.			CAPACITY (TONS)	NO	CAPACITY (TONS)	NO	SIZE (FEET)	NO	LARGEST CAPACITY (TONS)	NO.	LARGEST CAPACITY (TONS)
ATLANTIC REGION																	
HAWKER SIDDELEY CANADA LTD.	M	HALIFAX, N.S.	500 x 80[C]	2	360 x 80		250 TO 3,000	-	-	1	25,000	1	571 x 79	5	125	3	40
SAINT JOHN SHIPBUILDING & DRY DOCK CO. LTD.	M	SAINT JOHN, N.B.	1,100 x 120[C]	1	400 x 50	-	-	-	-	-	-	1 1	1136 x 125 453 x 60	4	75	5	25
FERGUSON INDUSTRIES LTD.	S	PICTOU, N.S.	275 x 60	1	350 x 60	1	2000	-	-	-	-	-	-	2	15	1	75
THE FISHERMEN'S LOAN BOARD OF P.E.I.	S	GEORGETOWN, P.E.I.	160 x 36	1	500 x 40	2	100, 600	-	-	-	-	-	-	3	10	1	12
ATLANTIC SHIPBUILDING CO. LTD.	B	LUNENBURG, N.S.	140 x 30	3	160 x 40	-	-	-	-	-	-	-	-	1	15	1	12
CHANTIER NAVAL LTEE	B	MIDDLE CARAQUET, N.B.	200 x 30	1	200 x 30	1	600 A	-	-	-	-	-	-	1	15	-	-
CANADIAN NATIONAL DOCKYARDS	R	ST. JOHN'S, NFLD.	-	-	-	-	-	-	-	-	-	1	560 x 70	DATA NOT AVAILABLE			
ST. LAWRENCE REGION																	
DAVIE SHIPBUILDING LTD.	M	LAUZON, QUE.	900 x 140	9	1000 x 120	-	-	-	-	-	-	-	-	9	85	7	80
MARINE INDUSTRIES LTD.	M	TRACY, QUE.	500 x 75	6	450 x 96	2	2000,5000	-	-	-	-	-	-	4	40	2	31
CANADIAN VICKERS LTD.	R	MONTREAL, QUE.	-	-	-	-	-	-	-	2	25,000 EACH	-	-	4	15	4	60
DEPARTMENT OF PUBLIC WORKS	R	LAUZON, QUE.	-	-	-	-	-	-	-	-	-	1 1	1150 x 120[B] 600 x 62[B]	DATA NOT AVAILABLE			
GREAT LAKES REGION																	
CANADIAN SHIPBUILDING & ENGINEERING LTD.	I	COLLINGWOOD, ONT.	730 x 75	2	730 x 75	-	-	-	-	-	-	1	518 x 56	5	120		SAME AS FOR BLDG. BERTH
PORT WELLER DRY DOCKS LTD.	I	ST. CATHARINES, ONT.	730 x 75[C]	1	170 x 40	-	-	-	-	-	-	1	737 x 80	3	125	1	55
HIKE METAL PRODUCTS LIMITED	S	WHEATLEY, ONT.	80 x 25	-	-	-	-	-	-	-	-	-	-	RENTED MOBILES			
CANADIAN SHIPBUILDING & ENGINEERING LTD.	R	THUNDER BAY, ONT.	730 x 75[C]	2	700 x 68	-	-	-	-	-	-	1	730 x 78	4	25		SAME AS FOR BLDG. BERTH
PACIFIC REGION																	
BURRARD DRY DOCK CO. LTD.	M	NORTH VANCOUVER, B.C.	500 x 75	3	500 x 75	1	1500	-	-	3	2,000, 10,000 & 12,000	-	-	3	87	4	95
YARROWS LIMITED	I	ESQUIMALT, B.C.	425 x 78	3	425 x 79	1	2500	-	-	-	-	-	-	3	45	2	25
ALLIED SHIPBUILDERS LTD.	S	VANCOUVER, B.C.	400 x 80	1	400 x 80	1	800	-	-	1	300	-	-	1	40	1	30
B.C. MARINE SHIPBUILDERS LTD.	S	VANCOUVER, B.C.	140 x 42	1	200 x 60	2	750, 1800	-	-	-	-	-	-	1	40	1	50
BEL-AIRE SHIPYARDS LTD.	S	NORTH VANCOUVER, B.C.	350 x 70	2	350 x 70	1	100	1	150	-	-	-	-	1	25	-	-
McKAY-CORMACK LTD.	S	VICTORIA, B.C.	200 x 50	-	-	4	10, 50, 100 & 1500	-	-	-	-	1	80 x 15	ONE 25 TON MOBILE			
McKENZIE BARGE & DERRICK CO. LTD.	S	VANCOUVER, B.C.	325 x 80	2	325 x 80	2	400, 900	-	-	-	-	-	-	2	25	1	165
STAR SHIPYARD (MERCERS) LTD.	S	NEW WESTMINISTER, B.C.	250 x 50	4	350 x 60	3	150 TO 250	-	-	-	-	-	-	30 TON MOBILES			
VANCOUVER SHIPYARDS CO. LTD.	S	VANCOUVER, B.C.	300 x 68	-	-	-	-	1	1100	-	-	-	-	5 MOBILES UP TO 15 TONS			
DEPARTMENT OF PUBLIC WORKS	R	ESQUIMALT, B.C.	-	-	-	-	-	-	-			1	1150 x 120[B]	DATA NOT AVAILABLE			

A. OWNED BY THE NEW BRUNSWICK GOVERNMENT

B. THE DEPARTMENT OF PUBLIC WORKS GRAVING DOCKS MAY NOT BE MADE AVAILABLE FOR MAJOR NEW CONSTRUCTION

C. USING GRAVING DOCK AS BUILDING BERTH

CLASS CODE

M - MAJOR SHIPBUILDING YARDS

I - INTERMEDIATE SHIPBUILDING YARDS

S - SMALL SHIPBUILDING YARDS

B - BOAT BUILDING YARDS

R - REPAIR YARDS

It should be stressed that what is being examined is shipbuilding methods and practices, not individual shipbuilding yards. The intent of the assessment is to provide a basis for determining in what respects, and under what conditions, Canadian yards might be able to further enhance their technical capabilities.

Building Facilities and Assembly Techniques

The size and degree of sophistication of facilities in Canadian shipyards vary from the major yards with modern equipment, some of which are capable of building bulk vessels up to 85,000 or 100,000 DWT, to the very small yards having a minimum amount of equipment and capable of building wooden boats only.

Table C-34 lists the existing launchways, marine railways, floating docks, graving/building docks and major crane facilities in the shipyards which were visited and/or filled in questionnaires. Also listed in Table C-34, is the dimensions of the largest vessel which can be built in one piece in each of these yards without any major changes to existing facilities.

Shipyards with privately owned graving docks have the alternative of using such docks either for the construction or repairing of ships. The Department of Public Works graving docks are primarily for repair and may not be made available for major new construction projects.

The general range of building facilities existing in major Canadian shipyards corresponds broadly to the domestic and export ship requirements that have prevailed in post war years and does not vary appreciably from that existing in medium sized

shipyards in the United States, United Kingdom, Sweden, Japan and other countries.

Specific information is limited on foreign yards that are comparable to the intermediate and small Canadian yards, but it is considered that little difference exists, particularly in the new Canadian yards. Three of the small yards in Canada have elevator lift type docks which allow for a flexible yard layout suitable for both shipbuilding or ship repairing using the same haul out or launching facility. All three of these yards are relatively new.

The major and intermediate yards listed in Table C-34 and many of the small yards have adopted the practice of producing the steel hulls of ships in sub-assemblies or blocks, weighing anywhere from 5 to 100 or more tons depending to an extent on the available cranage in a particular yard. These sub-assemblies, or blocks, are either produced complete in the steel shops or partially assembled in the shops and completed in the proximity of the building berth. They are then placed in position on the building berth where they are fitted to adjacent blocks and welded together. Sub-assembly of blocks of steel work in the shop offers many advantages, among which are ease of planning the work, easier allocation of workers and more effective supervision at the sub-assembly location. On the building berth sub-assembled blocks reduce the number of major lifts and allows for better co-ordination of various trades. The larger the block size the greater the economies derived from the method of construction depending on the type of vessel being built.

This method of steel assembly is in general use in world shipbuilding. Major foreign shipyards producing very large bulk carriers are equipped with cranes capable of handling blocks up to 800 tons with the majority of such yards being capable of easily handling blocks of 300 tons. However, the size of the blocks produced by shipyards in Canada cannot be determined on the basis of the largest block size desirable for the largest ship which can be produced, as management must take into account the mix of vessels they may have to produce and may decide on an average block size of 50 to 60 tons despite the fact that they could produce much larger blocks. This has an effect on required floor area of steel shops, capacity of shop cranes, capacity of trailers for transport etc.

Outfitting at the sub-assembly stage is a further practice that is widespread. In the major foreign yards, piping, electrical installation, ventilation systems, beds for auxiliaries, components and so on, are all installed in the blocks, in the shops, or at outfit areas, and the blocks are transported to the berth where the sections are welded together and the outfit installations are connected. While it is difficult to determine the exact tangible savings realized by outfitting of the blocks, it can be readily appreciated that installation of equipment in the blocks is much easier than it would be on the building berth after the units are connected together, where access becomes limited and handling is greatly increased.

With the exception of most major yards, Canadian shipbuilders consider hull work and outfitting work as two very distinct phases in shipbuilding, and carry out these phases at different times during the construction of a vessel. Several of the major yards carry out some outfitting work prior to the erection of the blocks at the ship, that is at the same time as the blocks are being built in the shop. However, lack of lead time and the need for materials and components to be purchased from world wide sources prevent the yards in Canada from obtaining full benefit from block outfitting in the shops. Some piping, electrical and ventilation work can be carried out at this stage but it is difficult to finalize the outfit in any one block prior to erection on the berth. Another factor limiting block outfitting is that the layout of the steel shops is such that few can outfit blocks indoors because this would greatly reduce steel production. Weather conditions in the average Canadian shipyard makes it generally impractical to outfit blocks in the open on a year round basis. In Canada, to take full advantage of outfitting of blocks prior to ship assembly, it would be desirable to have covered areas for such work adjacent to warehouses handling all outfitting components. However, this would only be of benefit if sufficient lead time was available to permit delivery of all components and materials prior to commencing outfitting of blocks and this, in practice, is not always possible.

Planning and scheduling

Canadian shipyards have the reputation of being among the world's fastest producers of custom designed ships when production time is measured from date of contract signing to ship delivery. Historically, most Canadian shipyards have had a relatively small order book and have built a wide variety of ships. These factors combined, present a difficult situation in relation to detailed planning and scheduling in the early stage of a contract due to:

- lack of sufficient lead time for preparation of detailed drawing and technical data,
- lack of sufficient lead time for procurement and delivery of materials.

Information for detailed planning and scheduling of materials and labour originates from the estimate, detailed drawings, specifications and purchase orders. In the early stages, therefore, the planning derives from the actions of the departments performing these functions. This does not mean that no detailed planning takes place but that, originally, planning is a function of the events instead of the other way around. Major yards, in most cases, plan originally on a very broad basis and then proceed with detailed planning as soon as information is available. In some cases, however, and particularly in the small yards, details are left to the supervisory staff, to be handled on a day by day basis.

The questionnaire to the yards asked what kind of planning technique was being used. Five major, one intermediate, and one small yard indicated that they make use of network planning, either CPM or PERT. None of the other yards showed that they used any kind of planning whatsoever, but they are known to use bar graphs to plan the major activities involved in construction of ships. These bar graphs usually plan functions on a very broad basis with the details left out so that they can be dealt with as required. This sort of planning requires that the details be taken care of by a number of individuals (superintendents, foremen, chief draftsmen, purchasing personnel, etc.) and since these individuals do not have the same overall view of the yard objective, the decisions they take tend to be department oriented rather than project oriented.

It is considered that the degree of planning done by those yards using Critical Path or Pert is on a par with that recorded in British and American yards. It is interesting to note that the Canadian yards using network planning generally are the yards using more advanced building methods, including outfitting at the sub-assembly or block stage. In these yards (as in similarly sized yards in other countries) network planning usually incorporates completion dates for preparation of specifications, the completion of drawings for hull work, and the completion of drawings for advanced outfitting which is also coordinated with schedules for the hull work. Also included is the placing of orders for materials and equipment as well as required delivery

dates. In major yards abroad, which build very large ships, network planning extends to detailed direction of individual workers by task. Such a degree of planning and scheduling is necessary for that type of operation but is not appropriate to the Canadian situation.

Purchasing and expediting

Except for a few cases, Canadian shipyards are independent from each other and, furthermore, the majority of the ships ordered from Canadian yards are of individual design or "one off" type. This necessitates the purchase of material and equipment on a per ship basis.

Because of their location with respect to steel suppliers, it is often necessary for yards to carry a large steel inventory. Many yards involved in steel repair work carry a quantity of steel in various shapes and plate thicknesses so that they may be in a good position to commence work immediately should a repair job come up.

The relatively low and varying demand for individual items of equipment used in ship construction has limited the ability of Canadian suppliers to manufacture economically in this country, and has resulted in purchase of foreign equipment to an extent that is estimated elsewhere in this report at 40% of the total value of materials and equipment used.

In consequence, there are added costs and lengthened delivery times compared with foreign competitors. Correspondence, expediting, and customs clearance, together with the freight, insurance and duty costs, add to the delivered price of the equipment

and are reflected in the cost of Canadian built vessels. The need to deliver the vessel in the minimum time, coupled with arrival of materials perhaps as late as a few weeks before delivery of the ship, prevents Canadian yards from taking full advantage of block outfitting.

In contrast to the above situation, yards in countries such as Germany, Japan, Britain, Sweden and the United States are often part of large corporations controlling other shipyards and/or manufacturers of material and equipment required in shipbuilding. In many cases, steel is obtained from the parent or sister company which is often located near the shipyard. Steel inventory can therefore be kept to a minimum, to the point where some major Japanese yards carry only nine to fourteen days supply of steel. The main and auxiliary equipment is often obtained from within the corporation or from manufacturers in the close vicinity which results in communications between the yard and the supplier being much superior to the Canadian situation. Also, since the yards are often part of a group of yards, and in some cases build conventional ships in series, the ability to order multiple components to the same specifications is frequently the rule, whereas for Canadian yards, it is the exception. Multiple procurement also can result in more importance being given to the order by the supplier from the point of view of both price and delivery. Such opportunities, however, are not open to Canadian shipbuilders.

Loft

While almost all yards in Canada continue to use wooden templates to some extent for lofting, there is a substantial usage of more advanced techniques.

Five yards reported use of tenth scale lofting, and in three of these the tenth scale lofting is adaptable for tape control. Another yard uses the photo projection technique. The practice in Canada is generally to use the more advanced method of one tenth or one hundredth scale drawings directly in conjunction with flame cutters, which is somewhat different from that elsewhere e.g. in Japan, the transition from one tenth to full scale is by use of projection towers.

Studies Have been underway in the U.S., Europe and Japan for a number of years on the development of computer programmes intended to replace the conventional design, drawing and lofting stages of ship construction. One such system is called Styrbjorn and is described in the article on the Swedish Shipbuilding Industry which is listed in the bibliography. The maximum value of such systems can, of course, be obtained only when a large volume of series production vessels are being built.

Steelwork

The value of steelwork (that is the total cost of the material and direct labour used) represents some 30% to 45% of the cost of an average Canadian built ship. This is obviously an important area for improvements in methods and practices, and one in which some of the major, intermediate and small Canadian yards have made changes in the past. There is potential for

further improvement, but the extent to which this may be achieved depends in part on the volume and diversity of work available. The flow of steelwork is described in some detail so that comments may be made on the present situation and possibilities for change.

Upon receipt, steel is checked and stored either outside or under cover. The storage of plates and shapes occupies a large amount of space since it is desirable to stockpile in a way that will permit quick withdrawal when required with the least amount of sorting, handling and rearrangement. Some major yards order steel by standard sizes as far as possible in order to minimize the storage space and handling required, but difficulties occur when such yards are engaged in the construction of various types of vessels at the same time.

Canadian shipbuilders have adopted two different basic systems for storing steel as received from the mills and for handling it between storage and fabrication. The medium to large sized yards store the plates on the flat and use overhead bridge cranes to retrieve and carry to the shop. The traditional hooks and grabs are generally used to lift the plates but a few yards use magnets. The small to medium sized yards generally store their plates on edge in racks, mainly consisting of uprights to keep the plates from falling over, and retrieve from storage and carry to the shop with mobile equipment such as cranes or lift trucks.

Three major and one intermediate yards are equipped with mechanized facilities to prepare the steel surface

prior to the start of fabrication. These facilities consist of a conveyor system to convey the plates through a drying and descaling process (sandblasting or shotblasting) and a paint priming system prior to delivery to the shop. In the majority of these cases plates are re-identified manually. The cost of such facilities is about one-quarter of a million dollars depending on size and degree of sophistication.

Upon entering the shop the steel goes through the marking and burning processes. While hand marking, hand burning and oxy plane burning are still extensively used, a number of labour saving devices have been adopted by some yards. Among these devices are one-tenth scale equipment, one-hundredth scale negative and tracing equipment. Three of the yards have tape controlled equipment for flame cutting of shaped steel. The cost of a complete medium size tape controlled burning setup is in the neighbourhood of a quarter of a million dollars.

Full benefit from expenditures on such equipment and on mechanized steel preparation depends on a high degree of utilization, which in turn requires both a consistently good volume and a well balanced flow of work.

Following the burning operation, the steel is sent to an area for panel fabrication as applicable; then it is assembled into sub-assemblies or blocks. The transfer from the burning to the panel and sub-assembly area is done either by overhead cranes or with mobile equipment. In either case it requires

manual operations to hook the plates onto the crane and to operate the crane to the assembly area. Here again a few major yards make use of electro-magnets to lift the steel.

The steel assembly crew usually consists of skilled workers of different trades, mainly platers, shipfitters or shipwrights, tackers, burners and welders. Because of the strong trade demarcation that exists in some yards, it is difficult to allocate the right number of men in each of these trades and keep the efficiency high at all times, regardless of the fluctuation in the demand for each one of the trades at various times while the blocks are being assembled. This problem of demarcation is virtually non-existent in the small yards.

The building of the blocks is one stage in the construction of a vessel where detailed planning and coordinating is most necessary in order to avoid costly delays. In some Canadian yards, the blocks are built from individual components whereas in other yards, mainly those capable of handling larger blocks, the individual components are welded into minor sub-assemblies before being made part of the blocks. Most yards are equipped with the standard unionmelt welding machines for straight-line welding. Six yards have invested in some form of automatic or semi-automatic welding equipment for panel fabrication. One Canadian yard is equipped with prototype one side welding equipment. The use of this equipment eliminates the necessity of turning the plates through 180 degrees for back welding.

From the above description of the practices presently employed by Canadian shipyards, it is obvious that improvements have been made in steel handling, marking, burning and welding. In general, such improvements require substantial capital investment which will only be undertaken if it can be based on confidence in a future substantial volume of work. These conditions have not prevailed for Canadian yards and thus the improvements that have been introduced have not yielded the full benefit which is available when they are built into a production line and matched with equipment of similar capacity. There is a distinct limit to the productivity gains that can be realized in a shipyard even with the latest steelworking equipment unless a major investment is made in handling equipment. That, in turn, is subject to varying degrees of productivity increase unless the yard can be laid out with its steel stockyard, its fabricating shop, and its building docks or launchways in as near a straight line as possible, where full benefit can be gained from a reduction in handling.

Volume of work coupled with series production has permitted many of the major yards in foreign countries to introduce a substantial degree of automation into their steelwork processes. The effect of automation has been even greater in the newly built yards which have been laid out in a way that takes maximum advantage of mechanized flow processes for steelwork.

Another factor favouring foreign yards is a reported modification in the traditional attitudes of labour. In Japan,

traditional demarcation of trades is said to be in the process of elimination, with it being common for workers to carry out tasks in more than one trade as opposed to the single craft-oriented workmen in most countries. This trend is reported to be developing in Sweden also, and it should be noted that more British yards now have so-called "flexibility labour agreements" which allow for a reduction in trade demarcation. The possibility of similar changes in Canadian yards merits continued examination by management and labour.

Some comments on the future investment possibilities in Canadian yards are appropriate on the basis of information obtained from yard questionnaires. Twelve of the responding yards indicated a wish to increase the capacity of their yards either in terms of the volume of work they can handle or the size of ships they can produce. Three of these are major yards that have plans to improve their steelworking facilities in an organized and integrated fashion, taking further advantage of automated methods, so that the end result would be a more modern and efficient shipyard. Volume of work would be a major factor in putting these plans into effect. It is evident from the questionnaire returns that these are yards which are also pursuing improvements in other areas as part of a progressive development programme.

Outfitting

Outfitting, as known to the shipbuilding industry, covers a large number of interlocking activities involving many trades such as those engaged on machinery installation, pipe fitting,

electrical work, sheet metal work and joiner work etc. These activities are less adaptable to automation than those related to the steelwork where automation in material handling and fabrication can be achieved to a fairly large extent. Also, during the outfitting period, it is necessary to employ several crafts in the same areas of the ship at the same time, resulting in the possibility of crowded conditions and lower efficiency. The interlocking requirements of the activities, that is the necessity of having the work of a certain trade completed before that of other trades can proceed, calls for detailed scheduling. The control of this scheduling is made more difficult due to the fact that a number of tradesmen may be working for sub-contractors and thus are not the direct responsibility of yard supervision. The large number of purchased components required to outfit a vessel emphasizes the importance of timely deliveries of these components for an efficieht outfitting operation. This applies not only to shipyard purchases but also to components supplied by the shipowner. This highlights the necessity of intergrating the purchasing and expediting in the overall outfitting schedule.

All of the major Canadian yards and some of the intermediate and small yards develop a very detailed schedule for the outfitting, taking into consideration the integration of purchasing and expediting of components with the required completion of each phase of outfit work. Major yards, in general, carry out block outfitting to the maximum extent possible dependent on delivery of

materials at that stage. Some other yards pay inadequate attention to the planning and scheduling of outfitting work, purchasing and expediting sometimes being carried out without sufficient regard to the vessel delivery committment. Also, in such yards detailed scheduling of the work sequence of the various trades and the allocation of the men is left to the yard supervision to be dealt with on a day to day basis without the benefit of an overall plan.

Since it is impractical for some yards to employ skilled workers in all trades involved in ship construction, it is necessary to have certain phases of outfitting carried out by sub-contractors. The number of trades or types of work sub-contracted by the yards varies from one to six, the average for the country being two. This average has remained fairly constant from 1958 to 1969. An exception to this generalization is the Atlantic region where a substantial increase in the amount of work sub-contracted has taken place in the last two years; this is dealt with more specifically in the section on the Atlantic region. It may be noted also that, in small yards, much of the outfitting is carried out by sub-contractors, particularly such work as piping, electrical, sheet metal, deck covering and insulation. The main function of the shipbuilder in such cases is therefore to coordinate the sub-contract work in order to avoid concentration of labour in one area and still achieve the delivery date of the vessel.

Outfitting in foreign yards, other than the very large yards, is carried out in much the same way as it is in the major and

intermediate yards in Canada with a trend towards outfitting at the block stage and emphasis on detailed planning and scheduling but with some greater use of sub-contracting as a result of the geographical closeness of building yards. Very large foreign yards employ detailed methods that are not always appropriate for Canadian circumstances.

Management Controls

The major shipyards in Canada record their expenditures for labour and materials on a detailed cost schedule covering from 150-200 main accounts with 2 or more sub-sections for each main account, each of these in turn being broken down into trades, resulting in a fairly detailed breakdown being recorded for each ship built.

Smaller yards generally use less elaborate cost accounting system and deal with labour and material distribution on a very broad scale covering steelwork, piping, electrical work, sheet metal work, machinery, etc., in lump figures. Others simply record labour expenditures on a trade classification basis.

Estimates for ships are, for the most part, prepared on the same format as the recorded costs in order to make full use of historical data for similar ships. There are exceptions i.e., in the case of steel, an overall "evaluated" manhour per ton figure will be used rather than applying hours to each steel account or sub-account. Similar exceptions apply to other sections of the ship estimate.

From the above it follows that the shipyards with the most sophisticated cost accounting system are also the best equipped to prepare a budget for material and labour expenditures on a fairly realistic basis when a contract is received. However, in some instances, such information is insufficiently broken down on the labour side to provide the production supervisor with more than a general control of labour throughout construction. This applies even in steelwork which is the most readily measurable aspect of construction, and since much less detail is generally available in outfitting than in steel, control tends to be less effective. Detailed control of the application of labour hours is therefore left very much in the hands of the supervisors of the various trades even in some major yards with fairly detailed cost accounting systems.

Seventeen of the responding yards stated that they compare man-hour performance with the budget and with physical progress weekly, three yards compare once a month, and two yards compare results only on completion of a contract. Considerable skill is required, particularly in the early stages, to estimate with reasonable accuracy the actual physical progress achieved during such short periods, when estimates are based on the completion of fairly large amounts of work.

Developing practice elsewhere, particularly in yards engaged in series production, is to prepare a working budget for each work item. A number of foreign yards use work measurement to determine time estimates, and in some cases the workers are on an

incentive plan whereby their earnings are related to the amount of work they perform. The full scale implementation of such budgeting and reporting systems is justified only if there is a substantial volume of work, but there is no doubt that the tendency is toward control of smaller items and this is beneficial for line supervision and management.

Use of Computers

Computers are being increasingly used for various operations in Canadian shipyards. The following table indicates the extent of use in various classes of shipyards.

Application	Major Yards	Intermediate Yards	Small Yards
Ship calculations	4	4	3
Lines fairing	4	2	2
C.P.M. or Pert	5	1	1
Cost and production control	4	-	2
Accounting	4	-	2
Stores inventory	4		1

It will be noted that the major yards are making the greatest use of computers at the present time. However, one small yard uses the computer for all of the applications listed. It should be mentioned that many small yards use the services of consultants for all or most of their technical work, and thus most of these yards may be indirectly using computers, at least for ship calculations. There is an increasing recognition on the part of management of the degree of assistance that can be obtained from computers in Canada as in foreign countries.

Overhead and Management Functions

In order to obtain an indication of the activities of

shipyards in overhead and management functions, the questionnaire asked yards to break down their current (September 1969) employees by type of activity.

Replies indicated that 77% of all employees were engaged in physical work and 23% were in the overhead and administration category. The table below shows the breakdown by function of these personnel:

Function	Percent of Total Overhead and Administration Employees
Marketing	3.5%
Research and Development	1.3
Design and Drafting	13.0
Production Control, Planning and Scheduling	3.9
Supervision	21.8
Management	3.9
Maintenance, Cranes and Stores	30.5
Other	22.1
Total, Overhead and Administration	100.0%

While these figures may not be fully representative because they relate to the position in one month only and because of differing definitions and categories among yards, they provide the basis - in conjunction with information obtained on visits - for the following general comments.

An average, Canadian yards employ one white collar worker for each 3.3 blue collar workers. Although there are not up-to-date comparable figures for other countries, in 1967 this ratio averaged one to 2.6 in 39 Japanese shipyards of varying sizes;

in the same yards in 1962, the ratio was one to 3.1. This indicates the emphasis being put on clerical, technical and managerial skills by Japanese yards and also the effect of increased automation in these yards. A very similar trend took place in Swedish yards between 1958 and 1967, these again comprising a range of yard sizes. It is interesting to note that those were years of progress for shipyards in those countries, when production volumes increased considerably and reported man-hours per DWT ton in 1967 declined to between one third and one half of the level in 1958.

The market for ships in Canada has been such that very little market research has been found to be justified by Canadian shipyards. In addition, very few yards other than the largest have had personnel engaged solely in sales for either new ships or ship repairs. Customer contact for new ship sales is generally maintained by the senior executives of a company backed up by the design, estimating and purchasing staffs. Captive business, created by direct control of shipyards by owners of shipping companies, or personal relations with customers, have been significant influences on the attitude of individual shipyards towards marketing in the past. Some major yards employ agents in various countries to maintain contact with owners for ship repair work.

Competitive tenders are now common for shipbuilding and to a large extent for ship repairing. The policy of customers concerning detailed specifications and design plans varies from those who supply complete details, to those who simply outline their

requirements and leave it to the shipyards to prepare the design and specifications and to submit a price.

Major and intermediate yards and some small yards in Canada have their own Naval Architects, Marine and Electrical Engineers and support staffs who are capable of producing detailed designs, specifications and working drawings for any type of vessel in the range of their shipyard building facilities. These shipyard designers and technicians are supplemented by the firms of consulting Naval Architects and Marine Engineers practicing throughout Canada.

Many of the small yards employ the services of consulting Naval Architects and Marine Engineers for the preparation of designs, specifications and working drawings. These consultants in some cases support the management in the supervision and inspection of the work, assist in scheduling and planning and deal with the ship owners and suppliers on many technical points. Such a service is particularly beneficial to small yards as they gain by receiving up-to-date advice without the need to maintain a staff of designers and technicians on a permanent basis.

International marine circles and professional societies are well aware that research and development by government and private professionals in Canada have contributed substantially to ship design. Special designs for cable-laying, icebreaking, lakers, self unloaders, ferries, package freighters, research vessels, naval units, tugs and special service barges have been accepted as leaders in their

respective fields. Canada has also led the world in many areas of detail designing including the application of aluminum and special high tensile steels, use of plastic piping, remote control of engine rooms, use of controllable pitch propellers and bow and stern thrusters. While developing designs and technology that have been found useful elsewhere, Canada has had access to the research and development findings in other countries.

The high fluctuation in demands on the industry have, however, created serious problems for shipyards and consultants with regard to the retention of capable experienced staff members. When the workload drops off, such personnel leave Canada for the United States and are lost to the industry with the result that replacements, required as workloads increase, must be recruited overseas. This results in a lack of continuity in procedure and the necessity for a "training period" while new staff members become familiar with the conditions and methods used in Canada.

In major shipbuilding countries, individual shipyards are often part of a group of yards, either within one corporation or by some mutual agreement, and it is therefore not necessary for each yard to maintain individual marketing and design teams. These functions in such yards are carried out by a central-office staff with each yard responsible for detailing and drafting.

Shipyards in most other shipbuilding countries employ a much larger percentage of university graduates than do Canadian yards. As a rule they are hired upon graduation from university, are given the opportunity to develop and gain experience, and eventually

are promoted to the managerial ranks thereby providing their company with continued talent and strength.

A new development, with marketing and wider implications, is the association since 1967 of a number of shipbuilding companies in different countries for exchange of technical information, common purchasing policy, joint study of marketing requirements, co-ordinated development of new design, and sharing of research and development costs. This association, called The Dorchester Club, comprises yards in West Germany, the United Kingdom, Italy and the Netherlands. A communication from this Club to the Committee indicates that technical and working groups are co-ordinating all activities in the fields of design, standardization and research and development. Common designs and standards have been established and different yards are building a number of like vessels to these designs. This kind of association among companies is a practice that may become increasingly prevalent.

Ship Repair

Based on Dominion Bureau of Statistics (1967) data with a few known revisions, it can be stated that there are fifty-eight ship repair establishments in Canada. Of these, thirty-two are in the ship repairing business only - three of them on a major scale - and the other twenty-six are combined with shipbuilding or boatbuilding facilities. The eight major shipyards in Canada all

engage in ship repairing resulting in a total of eleven major ship repairing establishments.

Ship repairing represents approximately 20% of total industry business on a dollar value basis. However, in relation to the total business of the shipbuilding yards only, ship repair constitutes some 14%.

Major ship repair facilities exist in St. John's, Nfld.; Halifax, N.S.; Saint John, N.B.; Lauzon, Sorel and Montreal, P.Q.; Port Weller, Collingwood and Thunder Bay, Ont.; Vancouver and Victoria, B.C.

As was shown in Table C-34, there are four graving docks in the Atlantic region with capacities ranging from 10,000 tons DWT up to about 100,000 tons DWT; one floating dock with a maximum lift of 25,000 tons; one elevator lift type dock with a maximum lift of 2,500 tons; several marine railways with lift capacities ranging from 100 to 3,000 tons.

The St. Lawrence region has two graving docks owned by the Federal Government and operated by the Department of Public Works with capacities of about 15,000 and 100,000 tons DWT respectively; two floating docks each with a maximum lift of 25,000 tons and capable of being combined by use of one section to lift a maximum of 27,500 tons; three marine railways of 300 tons, 2000 tons and of 5,000 tons lift.

The Great Lakes region has three graving docks, two of which are capable of handling maximum (730') size Upper Lakers; several small marine railways also exist in this region.

The Pacific region has two graving docks, one owned by the Federal Government and operated by the Department of Public Works with a capacity of about 100,000 tons DWT, and one small, privately owned of about 400 tons DWT capacity; four floating docks of 300, 2,000, 10,000 and 12,000 ton maximum lifts; two elevator lift type docks of 150 and 1,100 tons maximum lift; twelve marine railways ranging in size from 50 ton lift up to a maximum of 2,500 ton lift. No doubt several other marine railways exist in this region but details have not been obtained.

The normal facilities and manpower available at shipbuilding yards, the use of docking facilities for the dual purpose of building and repairing, and the contribution of ship repair to the overall workload to level off fluctuations in new construction orders - all of these emphasize the importance of ship repair work to shipyard management.

Some major ship repair establishments operate independently from shipbuilding operations, each having its own major docking facilities. One of these is located at St. John's, Nfld., one at Montreal and one at Thunder Bay, the latter two carrying on ship repairing along with industrial operations.

Some shipbuilding yards operate without any drydocking facilities of a major nature and make use of Federal Government docks. This applies at Lauzon, P.Q.; and Victoria, B.C.

Many smaller establishments not associated with shipbuilding and not having any "haul-out" facilities play a part in ship

repairing services in certain areas. Such establishments are found in the Montreal, Toronto, Welland Canal, Thunder Bay areas where they are important in servicing the large inland fleet and ocean-going ships. The Atlantic and Pacific regions also have a number of similar repair establishments all of which carry out afloat repairs.

In other countries, as in Canada, ship repair is carried on both together with, and independently of, shipbuilding. Again, the possibility of operating a specialized repair facility depends on the volume of work available. In this connection, a recent paper presented at Europort '69 on the "Rationalization of the Japanese Shipbuilding Industry: Today and Tomorrow", suggests that the trend will be to divorce shipbuilding from ship repair operations as shipbuilding becomes more and more automated and, as a consequence, demands differing skills from those required on ship repair. The author of that report also suggests that future ship repair facilities in Japan and in certain appropriate situations elsewhere will be large scale operations with several docks concentrating on ship repair work only. Lack of sufficient volume in any one area would make it impractical to justify such a large establishment in Canada.

Somewhat related to repair is the salvage of vessels in distress and refloating of sunken vessels, and Canada appears to be well served in this respect with salvage services being available on both coasts, the Gulf of St. Lawrence and inland waters, either associated with or separate from shipbuilding operations. On the St. Lawrence, where availability of salvage services is particularly important if blockage of

the ship channel or the seaway is to be avoided, one shipyard specializes in salvage work using personnel, equipment and facilities on a scale that is available only in a major shipbuilding yard.

Summary

Generally speaking, the existing facilities in most major and intermediate yards in Canada compare favourably with similar sized yards in other countries. The methods used by such yards for planning and scheduling, purchasing, loftwork, steelwork, outfitting etc., bear direct comparison with their counterparts in other countries. In fact, in certain aspects of automation, detailed planning and scheduling, and outfitting of steel assemblies prior to erection, some of the major yards may well be ahead of foreign yards of similar size.

This is not to suggest that Canadian yards do not have potential for further improvement in facilities and methods. Some yards are less advanced than others. All yards need to continually be improving their performance if they are to have maximum opportunities for competing in their traditional domestic markets and in new developments.

Major yards in Canada are not to be compared with the very large yards in major shipbuilding countries as the demand situation is entirely different. In Canada, such yards are limited to building vessels up to 100,000 DWT whereas major yards in foreign countries have facilities for building vessels up to 500,000 DWT or more. Furthermore, Canadian yards must have the ability to build all

types of vessels, generally on a "one off" basis, and do not have the benefits from series production that are available to major foreign yards.

The small yards in Canada, with a few exceptions, do not employ a substantial degree of modern technology other than partial sub-assembly of steel. Nevertheless these yards have proven that they are capable of obtaining a high productivity rate, probably due mainly to a lack of rigid trade demarcation. Comparable data for small yards in other countries is not available.

The availability of an adequate and efficient ship repair industry to service the coastal and inland domestic fleets, the ocean-going fleets and the fleets of Provincial and Federal Governments is most important. Present repair facilities in Canada compare favourably with facilities of similar capacity in other countries. It should be noted, however, that Canada's docking facilities are limited to the range of 85,000 to 100,000 DWT, and this will be insufficient to service the large dry cargo ships and tankers that will be operating on both coasts in the immediate future.

The Industry's Relative Competitiveness

The previous section has described in some detail the facilities and methods used in the Canadian shipbuilding and ship repair industry. However, full assessment of the relative competitiveness of the Canadian shipbuilding industry requires, in addition, a comparison of ship prices and productivity in Canada with those in other countries.

Many previous investigations into national ship building studied by the committee, have attempted to carry out such assessments, including studies by the Canadian Maritime Commission, the U.S. Maritime Administration, the Geddes Committee in the U.K., the Patton Committee in the U.K., the Webb Institute of Naval Architecture, and others. These efforts have met with limited success. Most recently, the U.S. Maritime Commission has awarded a major contract to a leading firm of U.S. naval architects to study alternative methods for determining construction differential subsidies.

Despite the difficulties, such measurements are significant for the present study and the Committee applied considerable effort to this matter in order to try to establish some reasonable comparison between Canadian and United Kingdom yards, the latter being the major competitors for Canadian shipyards under existing regulations.

All available literature on this subject was reviewed including material put forward by members of the Committee. Early in the study, the Committee considered approaching Canadian and U.K. yards for quotations for five different types of vessels. However, it was decided not to proceed on this basis since the information would be for a hypothetical situation, would not be prepared on a truly competitive basis, and would not provide a realistic comparison.

In another approach, prices for various types of ships were obtained from a number of shipping companies, consultants, the Department of Industry, Trade and Commerce, and from shipyards. Unfortunately the number of such prices was limited, and in any event

an effective comparison of prices quoted by different shipyards is very difficult even when the yards are quoting on the same specifications and plans, due to the differing interpretation of shipowners' requirements, the degree of choice of equipment allowed by the shipowner and - probably most important of all - the amount by which a shipyard might shade its price in order to obtain a contract. Comparison of prices is therefore not the best basis for comparing efficiency or productivity and it is preferable to make such comparisons on the basis of actual performance rather than price quotations, if possible.

The United Kingdom publication "Motor Ship" publishes details of estimated material and labour costs for three different types of vessels in October of each year. One of these estimates was compared with an actual estimate for a very similar ship, prepared under competitive conditions by a Canadian shipyard. While the detailed comparison did provide information in relation to apparent productivity and price differences, it could not be used generally because it was a single comparison, the ships were not identical, and while one estimate was prepared on a competitive basis the other was mainly for information.

A more general assessment is possible using the questionnaire which was completed by Canadian yards for the Committee. Responses yielded information on the breakdown of material, labour, and overhead and profit combined, for new construction in the years 1958, 1963, 1967 and 1969. From this information the average percentage breakdown of these elements on a Canada wide basis was derived as follows:

Material	55.0%
Labour	27.0
Overhead & Profit	18.0
Total	100.0%

The Geddes Report on the U.K. industry, page 48, states:

"The make-up of costs varies widely between different classes of ship, but the range for most ships of over 5,000 gross tons appears to be as follows:

Shipyard overheads	around 10%
Shipyard labour	15-20%
Steel	15-20%
Main engines	10-15%
Other machinery	15-20%
Other hull materials & equipment	around 20%"

These figures give the following approximate ranges:

Material	60-75%
Labour	15-20%
Overhead	10%

After allowing for profit at 5% (the Canadian figures including a profit percentage) the average for U.K. built ships can be taken as:

Material	67.5%
Labour	17.5
Overhead & Profit	15.0
	100.0%

It is possible on the basis of the Canadian and U.K. average percentage breakdowns to assess comparative costs and productivity if an estimate is made of the difference between Canadian and U.K. material costs.// This was done by taking into account the

average percentage of materials bought overseas by Canadian yards and allowing for freight, duty and agents commissions and by applying a differential for Canadian versus U.K. prices for materials bought in Canada. This procedure resulted in an estimated differential of 13.5% for materials used in Canada over the cost of those in the U.K.

The comparison that follows is based on the Canada and U.K. average percentage breakdowns shown above and on other basic criteria as follows:

- Canadian material costs 13.5% over U.K. material costs
- Canadian average labour rate $3.25 per hour in 1969 as reported by questionnaire yards
- U.K. labour rate $1.36 per hour based on data published by Shipbuilders' Council of America for 1968, increased 1.5% for 1969 on the basis of information from "Motor Ship".
- An assumed material value of $2,000,000 for the ship built in the U.K.

Application of this data results in the following comparison:

	United Kingdom			Canada		
	%	Dollars	Man-hours	%	Dollars	Man-hours
Material	67.5	$2,000,000		55.0	$2,270,000	
Labour	17.5	519,680	(382,000)	27.0	1,114,290	(342,800)
Overhead & Profit	15.0	445,440		18.0	742,860	
	100.0%	$2,965,120		100.0%	$4,127,150	

Comparing man-hours, the average Canadian breakdown shows 39,200 hours less than in the U.K. or approximately 10% higher productivity.

Comparing prices, the Canadian figure is $1,162,030 in excess of the U.K., an amount which is equivalent to approximately 28% of the Canadian price.

This assessment could be challenged on the grounds that the U.K. percentages given in the Geddes Report cover only the range for commercial ships over 5,000 gross tons whereas the Canadian average percentages cover the total mix of vessels built in Canada including naval and other government vessels. However, a check was made by a Committee member covering a group of Canadian shipyards and taking into account only merchant vessels (large, medium and small tankers, large and medium bulk vessels, package freighters, self-unloaders, coasters, passenger ferries etc.,) built over a long period and valued at over $300 million.

The average percentage breakdown obtained from this survey was as follows:

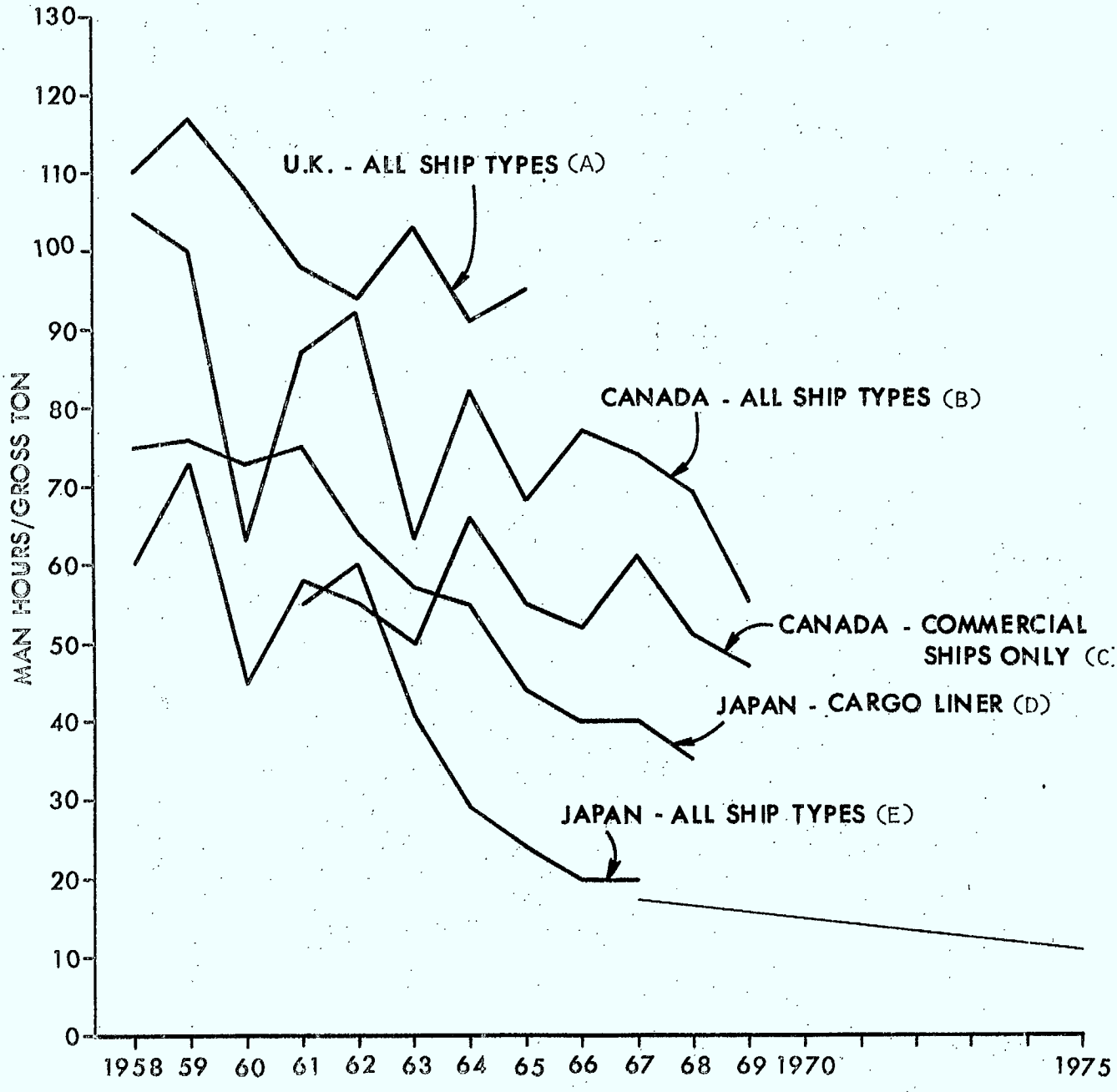
Material	55.0%
Labour	25.0
Overhead & Profit	20.0
	100.0%

Substituting these percentages for those shown in the example above, the result is that productivity would appear to be 17% higher in Canada than in the U.K. and the U.K. price would be approximately 26% lower than the Canadian price. As a point of interest, if it was assumed that Canadian material costs were only 7.5 percent over U.K. material costs, the productivity would be approximately 14% higher in Canada and the U.K. price would be approximately 24% lower than the Canadian price.

CHART C-2

MAN HOURS PER GROSS REGISTERED TON

CANADA — JAPAN — UNITED KINGDOM



SOURCE:

A) U.K. ALL SHIPS - SOURCE GEDDES REPORT OF G.R.T. LAUNCHED AND NUMBER OF WORKERS EMPLOYED ON NEW CONSTRUCTION.
B) CANADA ALL SHIPS - SOURCE SHIPYARD QUESTIONNAIRE.
C) CANADA COMMERCIAL SHIPS ONLY - SOURCE SHIPYARD QUESTIONNAIRE.
D) JAPAN CARGO LINER - SOURCE JAPANESE SHIPBUILDING SURVEY 1969 SEPTEMBER ISSUE OF THE MOTOR SHIP.
E) JAPAN ALL SHIPS - SOURCE PAPER ON RATIONALIZATION OF JAPANESE SHIPBUILDING INDUSTRY - TODAY & TOMORROW - T. SUZUKI NOV. 1969

Another means of assessing relative performance is by comparison of man-hours of labour per gross registered ton of ship produced. Chart C-2 gives a comparison of information available from various sources although comparable data for United Kingdom yards after 1965 is unfortunately not available. As is indicated by the data, Canada's productivity on this basis is much higher than the U.K. for all types of ships and there is an even greater difference when Canadian productivity is compared for commercial ships only.

Comparing the Canadian data for commercial ships only and the Japanese labour/GRT for a cargo liner, it is interesting to note that between 1958 and 1963, using this method of assessment, the Canadian level of performance was higher than the Japanese. However, since that time, the trend has been toward higher Japanese productivity despite an increased level of productivity in Canada. The historical performance in Japan for all types of ships is also shown in the chart and here the effect of large tanker production is very noticeable. The authorities quoted in Chart C-2 project further increases in Japanese productivity in the 1970's.

Summarising the data presented and fully recognizing the difficulties and limitations in an assessment of this nature, it appears that the price of the average U.K. built vessel may be in the range of 25-30% less than the price of a Canadian built vessel and also that average productivity in Canadian shipyards is between 10 and 15% higher than the average for U.K. shipyards.

CHAPTER VI

GOVERNMENT POLICY AND THE INDUSTRIAL POTENTIAL

Introduction

This chapter discusses in summary form the potential for the shipbuilding industry in Canada in light of the information and assessments made earlier.

Policies of both Canadian and foreign governments have been important influences on the past performance of the Canadian industry and will be important determinants of the industry's future. These policies are thus examined in the first sections of the chapter under three headings:

- government policy in Canada toward shipbuilding
- government policy in Canada toward shipbuilding in comparison with policy to other industries
- government policies in other countries toward shipbuilding.

This leads to comments on the industry's potential on the basis of its capacity and of the demand and supply possibilities. The chapter concludes with an evaluation of the costs and benefits for shipbuilding in Canada.

Canadian Government Policy Toward Shipbuilding

Government policy toward shipbuilding in Canada is discussed under three headings:

- government procurement
- protection
- fiscal arrangements

Government Procurement

For many years, it has been government policy that its shipbuilding requirements, whether naval or civilian, should be purchased in Canada. This policy has generally been followed (with occasional exceptions e.g. ferries and submarines), and government purchases of ships and of repair services have been major components of shipyard activity.

As the data presented earlier in Table C-18 showed, new construction for government departments during 1958-1969 ranged between 22% and 52% and averaged just over one-third of total new construction throughout the period. It is estimated that repair work on government vessels represents 10-15% of the shipbuilding industry's total repair work. Clearly, then, government procurement has been a major factor in the operations of the shipbuilding and ship repair industry in Canada and in the continuance of the industry.

Placement of government orders was a combination of allocation to regions and competition within regions up to 1965. Since then, under changed policies, government contracts have generally been awarded to the lowest qualified bidder, with competitive tenders on a national basis except in special situations such as emergency repairs or limit on vessel travel (where work is carried out in the region where the ship is based) and except for work that was specifically allocated to the Pacific Region during the 1965-70 transitional period.

The projected volume of government new construction requirements, presented earlier, together with continuing government conversion and repair requirements, indicate that government work will be of substantial importance in the shipbuilding industry's future activity, even with the limited government orders that are foreseen at the time of current budget stringency. Certain matters associated with this require comment:

(i) Although little is known at the present time regarding future naval requirements, there is a little doubt that there will be some continuing demand for naval vessels of types required to discharge future defense plans. Along with this will go the requirement for quality assurance programmes, whereby only yards that have met certain predetermined standards of organization, planning and performance will be able to tender on naval contracts. The initial cost and the manpower training involved in introducing such quality assurance programmes is substantial, but it is generally considered that - given a reasonable continuity of work - savings will be effected in performance that will make the effort worthwhile. The effect of these requirements could be to further concentrate the ability to meet naval requirements into fewer yards - a process that began with national tendering. Naval work could thus be less significant for the industry as a whole, although depending on the volume of activity, it could be very important for certain individual yards.

(ii) Regarding non-naval government work, an assessment is currently being made by a government inter-departmental committee of the desirability of placing all government civilian shipping under one operating authority. The rationale for this proposal is that it would enhance the level of government ship utilization and this could lead to a reduction in new ship requirements on the part of government due to greater usage of existing ships. A further outcome from such a development could be the adoption of practices and procedures that would enable the shipbuilding and repair industry, and the various marine supply industries, to perform more effectively. A study by marine consultants in 1965 found that there was scope for improvement in procedures in government purchasing for defense vessels, and it is considered that such opportunities continue to exist in all government marine purchasing. Adoption of uniform tendering procedures, equipment specification by function rather than by class of equipment, and co-ordination of purchasing, are examples of areas in which benefits could be realized.

(iii) It is also understood that the policy regarding naval dockyards is being examined by an inter-departmental committee. Such facilities are necessary to provide bases for the operations of the fleet and to supply naval ship repair

> facilities, particularly in electronics and weapons systems where particular capabilities are required. It would be reasonable to expect that, having provided such facilities, the attempt will be made by the government to use them to the greatest extent possible rather than go outside. At the same time there is a question here of considerable concern to the ship-building industry - the extent to which naval dockyards are being used and should be used for repair, refit and conversion of naval and non-naval government ships, over and above some predetermined level that might be associated with numbers of personnel employed, since it is not possible to determine costs in government establishments in the same way as in commercial operations.

These comments briefly illustrate some of the aspects resulting from government being a major source of business for the Canadian shipbuilding industry. Government work provides a substantial basis for industry activity, is keenly sought after, and - in certain cases - may be essential for yard survival. However, government business brings about increased, detailed, government involvement in industry operations and puts the government in a position to have a major influence on the development of the industry.

Past experience and current tendencies suggest that government and the industry will be closely associated in future. The matters for consideration then become the areas in which such

close association should be exercised, the way in which it can be most effectively carried out in the market and competitive and technological conditions foreseen in the future.

Protection

The second main element in Government policy toward shipbuilding in Canada is in the area of protection, as exemplified in Tariffs and Subsidies.

Tariffs

The tariff provisions applicable to shipbuilding have been in effect for some time (generally dating back to the 1930's) and have been little affected by the Kennedy Round.

The main change in recent years was the removal, in May 1966, of the long-standing provision that permitted drawback of 99 percent of the duty on goods used in the construction and reconstruction of ships in Canada. This was done in conjunction with other changes at the same time which are referred to later. The government announcement at the time of the change stated that the Ship Construction Drawback Regulations "had been introduced at a time when Canada's narrow industrial base made it difficult for the shipbuilding industry to find domestic sources; this is no longer the case".

Certain items relating to the shipbuilding industry continued to have duty free entry under particular provisions:

(i) ships, vessels, engines and parts, for use in commercial fishing.

(ii) other ships, if Commonwealth built.

(iii) iron or steel masts, angles, beams, knees, plates and sheets for ships or vessels.

(iv) manufactures of iron, brass or other metal, of a class or kind not made in Canada, for use in constructing or equipping ships or vessels.

(v) diesel or semi-diesel engines, of a class or kind not made in Canada, and parts thereof, for use in constructing or equipping ships or vessels.

Apart from the above, all other items are dutiable including, particularly, non-Commonwealth built ships for use in the coasting trade on which the duty rate is 25%.

It will be observed that an anomaly exists in the tariff structure for items important to the shipbuilding industry, in that the duty rate is zero for an end-product (Commonwealth built ships) whereas there are duty rates for ship components. This is the reverse of regular tariff practice where the duty rate ascends from zero on raw materials, through rates on semi-fabricated products, to highest rates on end-products, this structure being adopted to foster domestic manufacture. The zero rate on finished ships stems from agreements and the Canada Shipping Act of the early 1930's, and was apparently designed to give Commonwealth (primarily U.K.) built ships a preference in the Canadian market over other foreign ships. It is also relevant that U.K. builders are permitted by their tariff act to import free of duty all components used in building ships for domestic as well as export business.

The zero duty rate in the Canadian tariff for Commonwealth built ships is at variance with practice elsewhere in Canada's

tariff provisions. Recognizing that a differential prevails between the Most Favoured Nation and British Preferential rates in Canadian tariffs generally, an appropriate British Preferential rate accompanying the 25% Most Favoured Nation rate might be of the order of 20%.

Subsidies

In May 1961 the government introduced construction subsidy measures designed "to make it possible for Canadian ship operators to obtain new vessels from Canadian shipyards at reasonable and competitive prices instead of being forced to have them built abroad because of the lower construction costs that prevail in other countries" (Hansard, page 4711, 12 May 1961).

Subsidy rates were established for non-fishing vessels at 40% to 31 March 1963 and 35% thereafter; on fishing vessels the rate was 50%. The underlying purpose of the subsidy rate for commercial vessels was to bridge the gap with the cost of a ship built in the United Kingdom, this source being competitively the most important because of the zero duty on ships imported from there.

Under the subsidy regulations, the Minister of Transport was empowered to stipulate the amount of Canadian material that was to be incorporated in the ship in order to qualify for subsidy. Application of this tended to make ship and subsidy costs somewhat greater than they would have been in the absence of the Canadian content regulation.

As has been described earlier, introduction of the subsidy coupled with changed market conditions resulted in a substantial increase in activity; new commercial construction grew as follows:

	$ Million
1961	$ 63
1962	103
1963	130
1964	126

In February 1965, subsidy was suspended pending review of policy by an interdepartmental committee, and the government announced a revised programme of assistance for the industry in January 1966. The government statement included the following indication of purpose:

> "A first objective is that Canada should maintain a healthy and viable shipbuilding industry. The program is designed to assist in the improvement of overall efficiency to the point where the industry will rely on assistance or protection no greater than that which is accorded other similar Canadian industries."

The provisions of the new policy were:

- resumption of subsidy, 1 January 1966, at 25% for three years, and then reducing by 2% a year to 17% by 1972, these rates applying to commercial (non-government, non-fishing) vessels. (An amendment set the decline after May 31, 1969 at ½% per quarter up to February 28, 1973). The 17% rate was stated to be roughly equal to a 20% tariff protection for the shipbuilding industry.
- continuation of the current 50% subsidy rate for fishing trawlers. (This was reduced to 35% in December 1967).
- Canadian content requirement to be withdrawn.
- Ship Construction Drawback Regulations to be withdrawn (except for military equipment).

- amendments to be made to the Canadian Vessel Construction Assistance Act (discussed in detail below).
- transfer of shipbuilding subsidy responsibilities from the Canadian Maritime Commission to the Department of Industry.

This policy revision changed fundamentally the function of the ship construction subsidy. Whereas the subsidy had earlier been directed to equalizing the prices of Canadian built and U.K. built ships, its purpose under the new policy was to provide protection for the industry at a level that would eventually be similar to that for other Canadian industries. The changed function of the subsidy led to a new competitive situation for the Canadian shipbuilding industry, and accordingly devaluation of the pound in November 1967 was not followed by any change in Canadian shipbuilding subsidy rates. The new policy represented recognition that the zero tariff rate for entry of U.K. ships was inappropriate although the remedial means continued to be construction subsidy rather than tariff change. Imposition of a 20% B.P. tariff rate would have achieved much the same result as a 17% subsidy with the added effect, however, of raising Canadian prices for shipping to the level indicated by Canadian shipbuilding costs, and thus of raising the price of Canadian shipping services.

While the elimination of the Canadian content requirement allowed Canadian shipbuilders free choice of sources of supply, the withdrawal of the Ship Construction Drawback Regulations required the industry to pay duty on items that had earlier been imported virtually duty-free. As a result, class or kind rulings

which determine duty status for certain products, e.g. diesel and semi-diesel engines, have become significant for the industry and the interpretation given in these rulings has not always been considered satisfactory.

Canadian Flag

Canada has reserved the inland coasting trade west of Anticosti Island for Canadian flag vessels since 1 January 1966, and the statement is sometimes made that this represents further protection of the domestic market for the Canadian shipbuilding industry.

This is not so. Reservation of trade to Canadian flag vessels does not require that the ships be built in Canada, and it is not difficult for Commonwealth-built vessels to obtain Canadian registry and sail in this coasting trade. (It is possible for other foreign vessels to engage temporarily in coastal trade if suitable Canadian vessels are not available, on payment of monthly assessments equal to 1/120th of the value of the ship.)

The decision for a Canadian owner as to whether to build a vessel for Canadian flag operation either in Canada or abroad (particularly in the U.K.) depends largely on the relative costs and financial arrangements for the alternative situations.

Fiscal Arrangements

The major fiscal arrangement that has been important for the Canadian shipbuilding industry operates indirectly through influencing the financing arrangements of shipowners. It embraces

accelerated capital cost allowances for Canadian built ships (33-1/3% straight line per annum compared with the normal 15% on a diminishing balance for this kind of equipment) and exemption from taxation of recaptured depreciation on disposal of a ship provided the proceeds of disposition are to be used for construction or conversion in Canada of a Canadian registered ship under conditions satisfactory to the government.

Provisions of this type date from the passage in December 1949 of the Canadian Vessel Construction Assistance Act, the purpose of which was to encourage modernization of the Canadian fleet and shipbuilding in Canada. Permission to use proceeds of disposition by third parties encouraged the development of "angel plan" arrangements under which ships were built for non-shipping companies and leased back to ship operators under hire purchase agreements with an option to purchase under favourable terms (generally about 60% of the original cost of the ship). The ability of both the original and the final owners to claim capital cost allowances gave rise to tax advantages; in effect some 160% of the value of the ship was being depreciated successively by the two owners. These arrangements became particularly prevalent in the early 1960's after the introduction of the subsidy.

The Canadian Vessel Construction Assistance Act was repealed in March 1967 and its provisions relating to accelerated depreciation were incorporated into the Income Tax Act. It had originally been intended to withdraw the exemption from taxation of recaptured depreciation following disposition of a ship, but this provision was continued in respect of proceeds from disposition of

vessels owned before 1966 so long as the proceeds are used for replacement before 1974. If the taxpayer does not make an immediate replacement, a deposit must be made at least equal to the tax otherwise payable as guarantee of replacement.

The return of such deposits when a replacement is built by the taxpayer or by any other person before 1974, has given rise to buying and selling of deposits (or the right to redeem deposits). Also, in certain cases individual shipowners have found it more advantageous to finance a new ship in whole or in part with the proceeds from disposition of old ships than from subsidy. This latter practice could increase further as the rate of subsidy declines and as the 1974 deadline for use of proceeds approaches.

The combined effect of the accelerated depreciation and replacement provisions has been that a substantial part of Canadian commercial shipbuilding in post-war years has been financed through these types of arrangements.

A survey made in 1967 for a government-industry committee that was set up to study ship financing, found that the proportion of Canadian built ships financed by mortgages was relatively low. Owners did not require mortgage financing to a major extent. On the part of the lenders, more collateral security was (and is) required than on other types of real property loans (since certain provisions of national and international maritime law pre-empt the rights of even first mortgage holders), there is a reluctance to loan on individual ships and a preference for fleet

loans, and - particularly very recently - there is generally ample demand for money in more familiar fields. A specialized agency for ship mortgages of the kind that is found in other countries does not exist in Canada.

The substantial rise in interest rates in recent years has meant that the portion of shipowners' financial requirements that cannot be met from internal sources must be found at rates that are high relative to earning opportunities and to rates offered in other shipbuilding countries. Notes prepared for the Government - Industry Committee on Financing recorded that the terms and conditions on which shipowners can borrow in Canada are less favourable than those available in many foreign countries; this matter is returned to later.

No conclusive evidence was presented to that committee that business had been lost by Canadian yards due to unavailability of financing on satisfactory terms and the committee did not reach conclusions on the matters it was considering. A suggestion that a lump sum interest adjustment payment, which would correspond to the excess over 6% of the interest being paid for an 80% mortgage over 10 years, replace the accelerated depreciation provisions of the Income Tax Act did not find favour and was not proceeded with.

With the limited extent to which regular financial channels have been used, credit terms have not been a major problem for Canadian shipowners up to now because deferred income taxes

arising from accelerated depreciation and use of proceeds have been the sources of funds for much of their purchases. These sources may become even more important as subsidy rates decline and 1974 approaches, but problems in financing are likely to intensify after 1973, particularly if interest rates continue at relatively high levels. Also, the profit position of some shipowners does not permit them to take full advantage of fast write-offs, and in their cases present high interest rates and scarcity of commercial financing could act as barriers to the building of new ships.

The financing provisions relating to export sales should be noted. The Export Development Corporation can provide financing of long-term and, in exceptional cases, medium-term credit for major export sales of capital equipment and services (including ships) up to $800 million, of which $600 million is for lending by the Corporation for its own account and $200 million is for Government account. The terms for financing are understood to be those which were agreed by the 13 major shipbuilding nations of the Organization for Economic Co-operation and Development to be effective July 1, 1969: maximum duration 8 years; minimum down payment 20%; minimum net interest rate 6%. Commitment and guarantee charges applicable in Canada result in an effective interest rate that is above 6%.

Canadian Government Policy Toward Shipbuilding in Comparison with Policy to Other Industries

The foregoing analysis of the policies that are specific to the Canadian shipbuilding industry indicates that the

following are the main components:

- government procurement, both naval and civilian, in amounts that are significant for the industry.
- protection to domestic production through either subsidy vis-a-vis Commonwealth-built ships or tariffs applying to other foreign-built ships. The level of protection for shipbuilding has been higher than that for manufacturing industries generally; it is being reduced to the general level in stages.
- special fiscal provisions (accelerated depreciation) that are advantageous for shipowners and hence benefit Canadian shipbuilding.

It is very difficult, in general, to compare the impact and worth of specific policies for different industries, and to assess the relative level of government assistance being offered. One industry, e.g. shipbuilding, may receive protection from subsidy rather than through tariffs as in other industries; the effect may be similar but subsidies are highly visible and easily measurable. Tariff rates will vary between industries because of different historical and recent decisions as to the degree of protection for the particular activity. Accelerated depreciation provisions allow for deferment of taxes and thus provide a benefit compared to regular provisions. Participation by different industries in government research, development and manufacturing programmes will vary and may take different forms - shared cost, repayable grant,

tax rebates etc. - and it is thus difficult to quantify the relative benefits obtained from such programmes. Indeed, the more technologically oriented industries could be said to benefit to an extra degree from higher education in scientific disciplines and thus to be particularly favoured by government expenditures on higher education.

While it is very difficult to measure precisely the exact level of benefit received by individual industries from government programmes generally, it is possible to draw the following general conclusions:

- shipbuilding probably has benefited to a greater extent than other manufacturing industries from policies that are specific to an industry.
- shipbuilding probably has benefited to a lesser extent than other manufacturing industries from policies which are general for all industries.

These general policies refer to the government programmes for research, development and manufacturing, which are designed to upgrade scientific and technological skills and abilities in Canadian manufacturing industries. In general terms, these programmes apply in areas of high technology, high development content, and high risk, have sometimes originated in the defense sharing environment, and are often aimed at export markets in either defense or civilian fields.

The aerospace and electronics industries are the most common users of the programmes. Shipbuilding has been a relatively small participant up to now, although at least two companies in the industry have recently qualified for assistance of over $1 million

each under the Industry Modernization for Defense Export programme.

The question arises as to whether some inherent characteristics in shipbuilding as an activity or in shipbuilding as it has been carried on in Canada, limits the applicability of science and technology and thus of these assistance programmes in Canadian shipyards.

While the assessments in earlier sections were not specifically directed toward this question, they do cast some light upon it. It would seem that, for the general run of ship, neither the design nor production stages provide significant scope for scientific or technological innovation. Rather, the assessment of yard technology has indicated that the most promising areas for change in Canadian shipyards are in layout, planning and organization of basic production flow and processes. To be sure, specialized equipment will often be required and this may well come under the provisions of particular assistance programmes. But development of Canadian shipbuilding capability for established types of ships would appear to require assistance measures that are more production than R & D oriented, and this has important implications relative to the need for Canadian yards to modernize and with regard to the present non-availability of government programmes to assist such modernization.

This is not to say that possibilities for Canadian yards, arising from more advanced technology, should be disregarded. As the assessments of new developments indicate, there is a growing

potential for specialized types of ships - icebreakers, self-unloading barges, hydrographic and research vessels, off-shore and oceanology ships and equipment - and in many of these fields Canada already has special competence or is in a position readily to acquire it and to take a lead. If Canadian shipbuilding is to become a supplier to world markets, it is essential that every effort be made to perform effectively in the sophisticated marine equipment and vessel field, where scientific and technical excellence can reduce the effects of higher costs for basic materials and labour. This requires recognition by industry and government of:

- the opportunities that exist
- the actions, individual and joint, that are necessary to seize the opportunities

There would appear to be scope for the development of industry-government policies and programmes to realize the potential that is available.

Government Policies in Other Countries Toward Shipbuilding

The foreword to the publication "Maritime Subsidies", issued by the U.S. Department of Commerce in 1969 stated:

"With very few exceptions, the major maritime nations and those that are in the process of developing their maritime industries extend some form of aid, however large or small, to their shipping and shipbuilding industries."

The publication, like many other similar publications, goes on to examine in detail the assistance practices that are followed. It lists the following types of aid to shipping and shipbuilding industries and examines their utilization in 49 individual countries:

- operating subsidies
- construction subsidies (levels of which are shown in Appendix V)
- trade-in allowances
- government loans at low interest rates
- interest subsidies (the difference between the interest rates charged by commercial banks and incentive rates established by the government)
- credit guarantees
- accelerated depreciation
- tax-free reserve funds
- duty-free imports of materials for ship construction
- cargo preference
- cabotage restrictions

In addition to these direct and indirect subsidies, aids and grants, the publication notes that many governments provide a number of other social, economic and political types of assistance which have an impact on the competitive factors involving a nation's maritime activities.

The detail of the kinds of measures that have been adopted singly or in combination by different countries varies in

accord with the history of development of shipbuilding, ship owning, and foreign trade in each country. But the prevalence of these measures indicates that government assistance and intervention in the conditions within which the industries operate, has been the rule rather than the exception, and this has, in turn, been recognized by countries in establishing their own courses of action.

The adverse effects of this behaviour have not been overlooked. An article in the O.E.C.D. Observer in August 1969 stated:

> "For more than a decade, the role of government assistance in the shipbuilding industry's fight for markets has grown more and more decisive. The net result, however, has been that increased aid in one country provoked retaliation in others, while delaying the industry's unavoidable adaptation to changing market conditions and to technical progress".

In recognition of this, 13 shipbuilding countries in O.E.C.D. signed the Understanding on Export Credits for ships already referred to.*

The O.E.C.D. Council also passed a resolution in mid - 1969 on Government Assistance to the Shipbuilding Industry (from which the Canadian delegate abstained because of the proceedings of the present Committee on Shipbuilding in Canada). This recommendation described the Understanding on Export Credits as an essential first step towards "the reduction of all factors which distort normal competitive conditions", and instructed its Working Party on Shipbuilding to concentrate now on the removal of obstacles to normal shipbuilding competition resulting from:

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* Signatories were: Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, and the United Kingdom.

- direct building subsidies
- customs tariffs or any other import barrier
- discriminatory tax policies
- discriminatory official regulations or internal practices
- specific aid for investment in and restructuring of the domestic shipbuilding industry.

While this recommendation records no more than an intent, and has as yet not been succeeded by action by any major shipping country, it does record the broad policy that major shipbuilding nations considered should be pursued.

An extensive description of assistance measures in individual countries is given in the U.S. Department of Commerce publication already referred to. However, the major features of policy in the United Kingdom are particularly relevant to Canada and are now described briefly, including developments that occurred very recently. The shipping agreements of the early 1930's gave British ships a preferred position in Canadian market, and ships from that country - imported under zero tariff - offer the main competition to Canadian builders and provided the initial basis for Canadian subsidy policy.

According to information from the Department of Industry, Trade and Commerce, the following are the main elements of current U.K. policy toward its domestic shipbuilding and ship owning:

(a) Investment Grants are made both to shipowners and shipyards. For qualified shipowners of U.K. registered ships, Investment Grants replaced former Investment Allowances (which had depreciation of 140% of capital costs). Shipowners are now paid a subsidy of 20% of the cost of new vessels, regardless of the country of building, with depreciation up to the capital cost of the ship to the owner to be taken at any time. In November 1969 measures were taken to limit the conditions under which these grants would be given for foreign built ships. Other limitations include pro-rata repayment of the grant if the vessel is sold or lost within five years; pro rata repayment if chartered to foreign owners; restriction under certain provisions to U.K. residents; and provision for fishing vessels under separate legislation.

For shipyards, Investment Grants are available toward the cost of new productive equipment. The base rate for shipyards is 20%, the same as for all manufacturing establishments, except that there is a higher rate (originally 45%, now 40%) for establishments located in defined development areas, which include most of the major shipyard locations. Northern Ireland is covered separately, at 45%.

(b) Loans are made under guarantee of the Government, under the Shipbuilding Industry Act, with respect to the purchase, by owners of U.K. registered ships from U.K. yards, of ships

of 100 GRT and over. The limit, originally set at 200 million pounds, was doubled in December 1968 and raised again, in early 1970, to 600 million pounds. Loans made under this guarantee carry interest at a nominal rate of 5½% (6% effective rate) and are for an eight year term. As the current prime lending rate by U.K. banks is 9%, the banks are, in effect, subsidizing interest costs.

Approval of loans is given by the Government only when the building yard is satisfactorily carrying out the regrouping or other recommendations of the Geddes Report. The loan may be up to 80% of ship value provided imported equipment is not used when similar equipment is available from a U.K. manufacturer, in which case there is a pro-rata reduction of the credit.

(c) Payment by the government to shipbuilders of 2% of the value of new building. Initially this payment applied to export business only and was intended to provide compensation for indirect taxes. Subsequently this payment was extended to domestic new building also.

(d) Duty free import of all components used in ship construction.

The above are the main provisions applicable to U.K. shipbuilding and ship owning. They indicate that the United Kingdom is implementing commercial, fiscal and monetary measures of

assistance to these industries on a major scale and this, perhaps, is not surprising in view of the significance of the industries to the U.K. economy and in light of the competitive conditions that exist internationally.

The extent of U.K. assistance measures is immediately relevant to Canada because of the preferred position occupied by U.K. ships under Canadian coastal and tariff laws and regulations. This makes U.K. grant, credit and loan arrangements of immediate competitive significance to Canadian shipbuilders and ship owners.

As regards shipbuilding, the comparison of assistance measures is between the U.K. Investment Grants for the purchase of productive equipment, and any benefits to Canadian yards from R & D programmes. (National government procurement operates in the U.K. as in Canada).

For ship owning, the 20% Investment Grants, depreciation as rapidly as desired, and the availability of loans at low interest in the U.K. are to be compared, in benefits, with the subsidy and with the accelerated capital cost allowance prevailing in Canada for those who can fully utilize it and with the higher lending rates and lesser availability of credit.

Besides these measures which affect the current operations of shipyards and ship owners, there have been the continuing activities in the U.K. of the Shipbuilding Industry Board which, with further grants and loans, has been encouraging the grouping of yards and changes in methods recommended by the Geddes Report.

The Industry Potential

The following sections discuss in general terms the potential for the industry in light of its capacity and the demand and supply possibilities that exist.

Capacity

The building facilities in the shipyards of Canada have been described earlier in the report, and the technical capabilities of the industry and the range of ship types it can produce have also been commented on. It is desirable also to have a measure of the productive capacity of the yards, for assessment in relation to the volume of work that has been available and is in prospect.

Such a capacity measure, expressed as gross registered tonnage output of new vessels per year, has been established on the basis of employment and output data obtained from questionnaire yards.

Questionnaire yards estimate their full employment figures at a total of 16,000 men annually for new construction, ship repair and industrial work, which corresponds to an estimated total of 21,000 men for the industry as a whole. The number that would be employed on new ship construction only, based on the distribution of work force and mix of vessels that prevailed in the past twelve years, would be approximately 10,000 men in questionnaire yards. These estimates are based on the existing shipyard facilities in the industry being fully employed.

The estimated potential output per year of new vessels by all shipyards in Canada, in gross registered tons, was derived from the following:

(a) the potential work force engaged in new construction in questionnaire yards, approximately 10,000 men.

(b) average gross registered tonnage output per man per year during the 1958-69 period.

(c) allowance for increased productivity during the 1958-69 period.

(d) allowance for the output of yards, not covered by questionnaire, that were operating at the end of 1969.

The estimated current potential output resulting from this examination is 370,000 gross registered tons per year for the total shipbuilding industry in Canada. It is recognized, of course, that a shipyard with several launchways capable of accommodating seaway size upper lakers and a steel output capacity of 50,000 tons per annum could theoretically produce seven such vessels per annum, which would amount to approximately 126,000 gross registered tons for that yard alone. However, the 370,000 GRT output as estimated is based on the average mix of vessels built over the 1958-69 period and is not the theoretical maximum GRT output of new vessels by the industry.

Of the total capacity represented by this potential output, it is estimated that 128,000 gross registered tons is located in the Pacific Region, 164,500 gross registered tons in the Great Lakes and St. Lawrence Regions, and 77,500 gross registered

tons in the Atlantic region. Questionnaire data for the Pacific region show that over 80% of the total GRT produced over the past twelve years has been in barges (90% in 1968-69). The result of this is reflected in a higher potential GRT output for the region than would be the case if the mix of vessels was similar to that in other regions.

In comparison with the calculated capacity for all Canada of 370,000 gross registered tons, average output during the 1958-69 period was 151,000 GRT per year. In the more recent 1965-69 period, average output was 189,000 tons a year and when it is recalled that several yards were in operation then that have since ceased building, the industry was evidently operating at less than 50% of capacity in recent years.

Demand

The demand for ships projected for the 1970-79 period was shown in Table C-13 earlier, the overall requirement being 175,100 GRT per annum during 1970-74 and 177,700 GRT per annum during 1975-79. This projected demand covers the total predicted commercial requirements for coastal and inland fleets together with fishing vessels and government naval and non-naval requirements, insofar as these are known at the present time. However, it does not necessarily follow that all such vessels would be built in Canada. Under existing regulations, any of these commercial and fishing vessels could be built in a Commonwealth country and brought into Canada duty-free under Canadian or British registry, depending on the particular trade.

The forecast of new construction for commercial shipowners during the 1970-79 period is 162,300 GRT per annum. Of this tonnage, the requirement for the Pacific Region is 53,500 G.R.T. per annum, for the Great Lakes and St. Lawrence Regions 96,000 G.R.T. per annum, and for the Atlantic Region 12,800 G.R.T. per annum.

The Pacific Region requirements are mainly for barges and tugs, and so far this Region has been able to retain this as more or less "captive" business. However, a yard in Singapore is reportedly able to build these vessels for considerably less than Pacific Region yards, and the increased size of the barges and tugs on the West Coast together with the zero duty rate on imports from Commonwealth countries casts doubt on the future market being available entirely to Pacific Region yards.

In the Great Lakes and St. Lawrence Regions, the major portion of the demand is expected to be for Great Lakes bulk carriers. A continued slump in the inland shipping market could result in the new construction requirement over the next 2 or 3 years being well below the average forecast for the whole period, with a heavier demand for new ships in the last 7 or 8 years of the period under review. Although almost all new ships operating in Canada's inland trade have been built in Canada in recent years, this may not continue. The combination of labour problems - direct and indirect - and slow movement of grain have had adverse financial effects for shipping companies. These factors, coupled with the effect of the reducing scale of subsidy and high cost of money, could result in inland operators ordering United Kingdom built ships. Such vessels would

be brought in and placed under Canadian Registry.

Another development which may occur is amalgamation of Canadian inland shipping companies arising from financial pressures on smaller companies. This would bring about further integration of inland shipping operations to obtain maximum use of cargo capacity and to this extent could reduce the demand for new ships.

The introduction in the near future of 1,000 foot upper lakers by the U.S. inland fleet operators could have an adverse effect on the market for the services of the Canadian inland fleet. At the present time Canadian operators, with the building subsidy, accelerated capital cost allowances, and lower operating costs, have an edge on their U.S. competitors in Canadian-U.S. trade. This could change with the lower cargo rates possible with the use of 1,000 foot upper lakers which carry approximately twice the cargo of the 730 foot seaway size vessels. Any change in U.S. government policy regarding assistance to the U.S. lakes fleet could also be adverse to Canadian participation in Canadian-U.S. trades.

In the Atlantic Region, the forecast requirement for new ships is 12,800 GRT per annum, a substantial part of which could be in barge and tug type transportation. Such vessels could also be built overseas in Commonwealth countries and brought into Canada to operate under Canadian flag if within inland limits, or on Commonwealth registry if operating on the East Coast. Again, the declining rate of subsidy in Canada and the high cost of money compared with credit terms in the U.K. are factors which could result in orders being placed overseas.

In all, the projected demand of 162,300 GRT per annum for commercial ships stands in some risk of being high because of the considerations mentioned above. The projection is less likely to be low.

Supply

Referring to the total 176,400 GRT annual potential demand for new construction during the next ten years, this would result in an estimated operating rate of 48% of capacity for all yards. If all government new construction requirements were to be placed in Great Lakes, St. Lawrence and Atlantic Region yards during the 1970's, the potential demand for Pacific Region yards would be 53,500 GRT per year or approximately 42% of the total estimated capacity in that region. The other regions might have a potential demand of 122,900 GRT per year or approximately 51% of their total estimated capacity. Both calculations presume that all the vessels required would be built in Canadian shipyards.

The estimated current potential capacity for shipyards in all regions is based on current productivity, and does not take into account increases in productivity which will undoubtedly occur over the next ten years, even without major changes in existing facilities. Any such increases in productivity would have the effect of lowering the operating rates in the yards.

Considering all of the factors that have been mentioned just above, it is possible that the yards in the Pacific region may have an operating capacity of something less than 42% during the next ten years. For the Great Lakes and St. Lawrence yards, the position would appear to be somewhat more favourable since

they could achieve a 51% operating rate by building 78% of the commercial demand projected for their regions and 60% of the government and fishing vessel demand; here also, however, competitive developments and productivity increases would act to lessen operating rates and there is the possibility of particularly low demand in the early 1970's. In the Atlantic Region, the yards would need to build 22% of the Great Lakes/St. Lawrence Region requirements, 40% of the Government and fishing vessel demand, and all of the Atlantic region demand to achieve a 51% operating rate which, again, could well be lower.

While an operating rate of 75% of capacity would be generally considered satisfactory by the industry, rates of operation at the indicated levels are much too low for attainment of a high degree of productivity and it is necessary to consider means of increasing operating rates in the industry as a whole. Essentially, the options are to increase volume or to reduce capacity (or a combination of these) and each is discussed in turn.

Increased volume, over and above that forecast to be available from coastal and inland demand for ships and shipping services, could be available for the industry from five sources: exports, new developments in the Arctic and off-shore, closing of the coast to non-Canadian built vessels, establishment of a Canadian flag, Canadian built deep-sea fleet, and expanded manufacture of heavy industrial non-marine products.

With regard to exports, higher labour rates and material costs prevail in Canada than in most other countries that build ships for world markets. (It is not possible to assess the

differences precisely in the absence of the necessary basic data; sample labour rates in certain countries are shown in Appendix V). It is unlikely that these costs will generally increase abroad at a faster rate than in Canada and thus narrow the construction differential, and in any event it would be unwise to rely on such a development.

The possibility of Canada supplying ships to the world market thus depends on its relative productivity in shipbuilding. The earlier examination of comparative ship prices and productivity in Canada and the U.K. indicated that productivity in terms of labour man-hours is appreciably higher in this country and has been increasing over the years. Productivity is increasing in other countries also, however, and it is thus highly unlikely that Canadian productivity could be increased sufficiently to compensate generally for higher labour and material costs even with very substantial capital expenditures.

For construction of giant bulk carriers for export, for instance, it would be necessary to invest very considerable amounts of capital in facilities comparable to those elsewhere. This is not a feasible proposition for the Canadian industry. Canadian yards would be competing with a number of foreign yards that are already established and that have the capacity to supply world market demand for ships of this type.

In construction of smaller cargo vessels for export, substantial capital expenditures would also be necessary for series

production. In this way Canadian building productivity would be considerably increased, but labour and material cost differentials would still preclude Canadian yards being fully competitive in world markets on a permanent basis in the absence of additional measures of assistance. There may well be opportunities for Canadian yards to take care of special situations such as those arising from present long delivery times, but these would be temporary and not to be counted on as a regular source of business.

As mentioned earlier, there may also be foreign markets for specialized naval, oceanographic and research vessels, in the construction of which Canadian yards have knowledge and expertise. Measures by the industry and government to improve the possibility of exports might well be best directed to these types of ships and markets.

The second principal possibility for increased volume for the Canadian shipbuilding industry is in the area of new developments, including particularly those arising in oil exploration offshore. Again, the ability of Canadian yards to supply a substantial part of the types of marine equipment and vessels that will be required may depend on enhancement of existing production and technical capabilities.

A further important matter regarding these developments will be government policy regarding the terms and conditions under which foreign suppliers may be permitted to participate. Such matters are currently under study by another body, but this Committee on Shipbuilding wishes to record the significance of these potential

markets for the Canadian shipbuilding industry in light of the relatively limited demand that will likely exist for the industry in its traditional markets.

Other possible new developments exist in Arctic movement, but the timing of these and the conditions that might provide a market for the Canadian shipbuilding industry are highly conjectural at present.

A third possibility would be closure of the Canadian coast to non-Canadian built vessels. At present, Commonwealth built and other foreign built vessels can engage in Canadian coastal trade in accordance with governing regulations regarding carriage of freight and passengers in particular areas, and provision of other shipping services e.g. tugs, dredging etc. is open to a supplier from any country.

As the earlier analysis has indicated, replacement of non-Canadian built ships by Canadian built vessels in the coastal trades would not be immediately significant because few non-Canadian ships operate in these trades at the present time. On the West Coast and in inland coasting business virtually all cargoes are carried in Canadian built ships. On the Atlantic Coast there is some participation by U.K. built ships, but it is estimated that their replacement by Canadian built ships would add less than 5,000 GRT to present fleet tonnage, rising to at most 20,000 GRT by 1980. Also, closing the coast might not result in a full transfer of demand for ships to Canadian yards, since any resulting rise in the price of Canadian shipping services could have the effect of diversion of some traffic to other modes of transportation.

Closing the coast might also be advocated, however, on the grounds that new building orders for the Canadian lakes and coastal fleets might be placed abroad if Canadian yards cannot meet the situation created by declining rates of subsidy and more expensive financing. This in itself is not, of course, an absolute argument for closing the coast, since the objective being sought - building in Canada of ships for the Canadian domestic fleet - might be better accomplished by other measures.

A fourth possibility for increasing volume is the establishment of a Canadian flag, Canadian built, deep-sea fleet. The benefits and costs of operating such a fleet are being studied by the Canadian Transportation Commission. If there is justification for such operations, there may be potential volume for the Canadian shipbuilding industry in constructing ships for the fleet provided the necessary assistance is available.

Finally, increased volume for the shipbuilding industry may be possible through expanded manufacture of heavy industrial, non-marine, products. To do this on a sizeable scale, however, and to be competitive with large well established heavy industrial firms, the shipbuilding industry would have to invest in special facilities that would be, to a large extent, separate from their shipbuilding and ship repairing operations. A few yards already take part in this type of work. However, the majority of the yards are not located in areas where there are broad markets for semi-finished and finished products and a generally extensive industrial base. While

yards will undoubtedly attempt to increase their volume of industrial work, this is unlikely to be more than a supplement, generally, to their main activity of shipbuilding and would make use of common rather than special facilities.

Turning now to consideration of decreasing capacity by closing down some yards, the effect would be to concentrate new construction in fewer yards and to increase their activity. Productivity would improve because of the greater relative volume of work and less fluctuation in the labour force for individual yards. While such action would improve the situation regarding new construction, there could be a problem in maintaining adequate ship repair capability in some areas.

Shipyards in Canada are generally located hundreds of miles apart, serving thousands of miles of coastal and inland waters, (except for the Vancouver area where there are a number of small yards and a major yard). Reduction in the number of major or intermediate size yards that presently act in the dual role of shipbuilders and ship repairers could create a major problem for shipping companies requiring ship repair service unless some yards would have a large enough repair volume to continue with ship repairing without any shipbuilding activity.

During the past three or four years three shipyards have closed - Victoria Machinery Depot, B.C., George T. Davie Ltd., Quebec and Kingston Shipyards Ltd., Ontario. In addition, Canadian Vickers Shipyards Ltd. Montreal, closed their shipbuilding facilities and retained a ship

repairing operation. The closing of the facilities listed has not thus far affected ship repair capability because other shipyards continue operations in the same areas or, in the case of Canadian Vickers Ltd. and Port Arthur Shipbuilding Ltd., ship repair facilities are being maintained without shipbuilding.

Summary

In light of the prospective supply/demand balance for the Canadian industry it is evident that there is a surplus of shipbuilding capacity. Actions by the industry and government with respect to export possibilities and new developments may improve the demand position and thus raise yard operating rates. The apparently limited opportunities for doing so without major policy changes suggests, however, that the contraction in the number of shipyards in Canada which has been occurring for some years will continue.

There is need for major shipbuilding facilities at strategic locations on the coasts and inland waterways. These yards would concentrate on the efficient production of larger-sized vessels for the domestic market and would be in the best position to supply export markets under appropriate assistance arrangements. They could also supply the ship repairing needs of the Canadian domestic fleet and of international shipping, in conjunction with independent ship repairers. There would also be a requirement for a limited number of smaller shipbuilding yards in Canada to supply smaller-sized vessels to the domestic market (and abroad, if possible) and to meet local requirements.

Canada: The Costs and Benefits of Present Measures of Government Assistance to the Shipbuilding Industry

One component of the Terms of Reference of the Committee was that it should examine and report on the costs and benefits of present measures of government assistance to the industry.

This section makes such an assessment to the extent that available knowledge and data allow. It also comments, when appropriate, on some of the conceptual and practical problems that are encountered in cost/benefit work and that make it difficult to establish dollar values.

Costs of Assistance

As the earlier analysis indicated, the main avenues of government assistance to the shipbuilding industry in Canada have been ship procurement, protection through tariffs and subsidy, and fiscal provisions including accelerated depreciation and avoidance of taxation on recaptured depreciation provided proceeds of disposition are used for ship replacement. The costs of these government measures are assessed in turn.

Government Procurement

Consideration of government procurement as an element of assistance to the shipbuilding industry raises in a fundamental way the difficulty of establishing the costs and benefits of alternatives, because ideally it would be desirable to assess the situation as it is now in comparison with what it would have been had the government not satisfied its shipping requirements in Canada.

As can be readily appreciated, the attempt to carry out such an assessment is highly conjectural in general terms, and would be particularly speculative for the shipbuilding and ship repairing industry. Elements for consideration would include the price differential at which government naval and civilian ships might have been bought abroad rather than in Canada and circumstances under which Canadian yards might have satisfied government requirements in the absence of government assistance for commercial shipbuilding.

The attempt to carry out such assessments would require a substantial number of assumptions of questionable validity. It is not, therefore, possible to measure practically the costs and benefits of government procurement. While it is obvious that government work amounting to one-third of industry activity in 1958-67 has been of major benefit to the industry, it should also be recognized that the costs of the procurement policy can be attributed to the policy objective of national independence as well as to industry support. No meaningful comparison of benefits and costs can thus be made in respect to this aspect of government assistance.

Tariffs and Subsidy

Canada's commercial policy has generally been to protect domestic manufacturing industry through tariffs, and the tariff structure that has evolved has been reasonably similar for manufacturing industries.

For the shipbuilding industry, however, an important exception to general tariff practice has already been noted, whereby U.K. built ships can enter Canada at zero duty rates. Given the 25%

Most Favoured Nation tariff that exists, an appropriate tariff rate for British built ships would be some 20%. This 20% rate is approximately the equivalent of a 17% subsidy (i.e. deduction from Canadian costs). It follows, then, that the first 17 percentage points of any subsidies that have been given should be regarded as the extension of protection to shipbuilding in the same way and to a similar extent as the tariff protection afforded other industries, although in the readily visible and measurable subsidy form rather than diffused through prices in the economy as with a tariff.

The following table lists the subsidies disbursed up to March 31, 1969:

	$'000		
Fiscal Year	Trawlers	Other	Total
1961-62	$ -	$ 2,025	$ 2,025
1962-63	796	21,704	22,500
1963-64	5,475	34,525	40,000
1964-65	3,749	28,251	32,000
1965-66	4,948	35,565	40,513
1966-67	17,883	17,938	35,821
1967-68	20,463	18,869	39,332
1968-69	5,132	17,201	22,333
Total	$ 58,446	$176,078	$234,524

Taking into account the subsidy rates that applied in particular years, and attributing 17 percentage points to a general level of protection, it is calculated that some $116 million of subsidy payments were protective in nature and $118 million were subsidization as such. The summary calculations are as follows:

TABLE C-35

CANADA

FEDERAL GOVERNMENT

SUBSIDY AND CAPITAL ASSISTANCE PAYMENTS

1961 - 1968

$ Million

	1961	1962	1963	1964	1965	1966	1967	1968
Subsidies:								
Agricultural	$ 94	$ 128	$ 140	$ 143	$ 142	$ 156	$ 178	$ 212
Emergency Gold Mine	12	14	15	15	15	15	15	14
Maritime Freight Rates	13	13	11	17	10	20	14	14
Movement of Coal	17	18	19	20	26	32	34	12
Grants to CBC	66	71	75	84	93	107	133	142
Payments to Railways under the National Transportation Act	46	50	70	76	68	136	120	96
Miscellaneous	37	28	25	24	16	30	30	28
Total - Subsidies	285	322	355	379	370	496	524	518
Capital Assistance:								
Construction of Commercial and Fishing Vessels	1	14	34	35	46	28	43	28
Northern Railway Line	-	8	20	25	13	2	2	3
Winter House Building	-	-	-	14	17	17	-	-
N.R.C. re Research in Industry	-	-	1	2	3	4	2	-
Industrial Employment Opportunities	-	-	-	-	-	3	14	17
Expansion of Scientific Research	-	-	-	-	-	-	1	12
Other	17	16	19	13	9	8	6	12
Total - Capital Assistance	18	38	74	89	88	62	68	72
Totals, Subsidies and Capital Assistance	$ 303	$ 360	$ 429	$ 468	$ 458	$ 558	$ 592	$ 590

Sources: DBS National Income and Expenditure, and Governments Divisions.

Note: The data in this table are for calendar years, whereas the data on page 157 were for fiscal years.

	$ million		
	Trawlers	Other	Total
Protection	$ 24	$ 92	$ 116
Subsidization	34	84	118
Total	$ 58	$ 176	$ 234

Thus on average over the period, about 50% of subsidy payments have been protective in nature, this proportion being somewhat higher for commercial vessels other than trawlers.

The extent to which subsidy or assistance is being provided to other fields of activity is of interest, although it should be recalled that other, less visible, forms of assistance are often of very great importance in many industries. The Dominion Bureau of Statistics records assistance information under two headings, subsidies and capital assistance payments. The data for the period 1961-68 is shown in Table C-35.

Subsidies to other modes of transportation are particularly interesting in relation to shipbuilding subsidies, recalling that the final effect of the measures respecting ship building and owning has been to reduce the cost of shipping services below what they would otherwise have been. As the Table shows, payments to railways under the National Transportation Act, which have been made since 1961 so as to maintain freight rates at reduced levels, increased from $46 million to a peak of $136 million in 1966 and were $96 million in 1968. Maritime freight rate payments have varied between $10 - $20 million per year.

Fiscal Measures

It should be noted that the absolute level of subsidy disbursements for shipbuilding is affected by the extent to which proceeds from disposition, rather than subsidy, are used to finance new construction. This method has been found attractive in recent years and total use of proceeds in 1968-69 was of the order of $30 million. With the declining rate of subsidy and the approach of 1974 when ability to use proceeds ceases, relative use of subsidies and thus the apparent cost of direct assistance to the industry could well be affected, to the extent that proceeds are available for use.

It is not possible to assess the cost to the treasury arising from deferment of taxes through use of proceeds for replacement, nor is it possible to measure the similar costs arising from the accelerated depreciation provisions under the Income Tax Act. The interdepartmental committee which, in 1965, reassessed subsidy provisions and levels, gave consideration to such assessments, but concluded that the necessary assumptions would have varying degrees of validity and that any precise cost to the Crown would be difficult, if not impossible, to calculate.

Benefits from Assistance

On the benefit side, as on the cost side, full assessment would require consideration of benefits arising from industry activity at various levels corresponding to various types or levels of government assistance. This is not practicable and thus the analysis proceeds by examining the benefits from the industry activity that actually occurred under the conditions that prevailed.

As a preliminary, however, some general matters regarding incidence of benefits should be mentioned. For instance, shipbuilding subsidies during 1961-65 carried a Canadian content requirement and part of the benefit in those years therefore was received by Canadian suppliers of steel and other equipment. As a further example, the intense competition that prevailed among Canadian yards for new construction has led to price quotations that have yielded "below normal" margins for overhead and profit; in effect, part of the benefit went to private shipowners and - it may be noted - to the government in respect of its orders. (As a further complication here, there is a substantial degree of integration or affiliation between some Canadian shipyards and shipping companies, and establishment of the incidence of benefit as between builder and owner becomes even more difficult). As a final example, it can be postulated that the effect of a zero tariff on U.K. ships and of a subsidy designed to equate Canadian shipbuilding costs with those in the U.K., was to provide shipping services in Canadian waters at rates less than they otherwise would have been. The ultimate beneficiaries were the users of the services, whether they were consumers, producers or governments, and measurement of the benefit is virtually impossible at this level of diffusion.

Not being able to assess benefit in any final sense, the procedure adopted is to examine the economic resources that were utilized by the industry, in terms of employment generated and materials consumed. Further sections comment on balance of payments implications and on indirect effects arising from the industry's primary activity.

TABLE C-36

CANADA

EMPLOYMENT IN THE SHIPBUILDING AND SHIP REPAIR INDUSTRY

	Total Employment in the Industry, as reported by the Dominion Bureau of Statistics	Employment on building, repairs and conversions, as reported by member yards of the Canadian Shipbuilding and Ship Repairing Association
	Number	Number
1969 Dec.	13,292	7,366
Sept.	14,758	8,175
June	16,281	9,904
March	17,210	10,940
1968 Dec.	14,576	8,978
Sept.	15,463	8,951
June	16,410	10,625
March	17,067	10,915
1969	15,385	9,166
1968	15,720	9,913
1967	18,929	12,733
1966	19,492	12,893
1965	18,586	12,362
1964	17,137	11,911
1963	18,011	12,797
1962	17,620	12,500
1961	15,039	10,001
1960	15,113	9,814
1959	14,384	10,352

Sources: 1. Dominion Bureau of Statistics. Annual Census of Manufactures 1959-67; Employment and Average Weekly Wages and Salaries for later periods.

2. Canadian Shipbuilding and Ship Repairing Association.

Employment

Total employment in the shipbuilding and ship repair industry during the 1960's fluctuated between 15,000 and 20,000 according to D.B.S. data relating to all the firms and all the activities in the industry. Employment increased after the beginning of the decade along with increased activity, but in recent years there has been a substantial decline as a number of yards ceased operations and volume of work dropped from the peak in 1966.

The D.B.S. data are shown in Table C-36 opposite, together with employment figures compiled by the Canadian Shipbuilding and Ship Repairing Association. These latter data relate to ship-building, repair and conversion activity only (i.e. excluding the direct labour engaged on industrial work and a proportionate share of the indirect labour and salaried overhead personnel), and the data are for the member yards of the Association, which numbered 12 at the end of 1969. The Association figures are, however, useful as a supplement to the D.B.S. information; the trends in yard employment they show for the 1960's correspond to those indicated by the D.B.S. data (though at a level that is about 60-70% of total employment in the industry), and these yards carry out a very large part of all new construction activity.

As the table shows, there has been a substantial contraction in employment in 1968 and 1969 from the levels that had prevailed during 1962-67. The decline began toward the end of 1967 and the trend has been steadily downward since (although monthly figures are subject to some seasonal fluctuations). By December 1969

TABLE C-37

CANADA

EMPLOYMENT DATA FOR
SHIPBUILDING LOCALITIES

Locality	Employment in shipbuilding, ship repair and conversion		Employment in all manufacturing activities
	Average 1966	Late 1969	Late 1969
Halifax	1,200	1,200	8,000
Saint John	1,175	1,800	7,500
Quebec	2,850	1,000	23,000
Sorel	1,550	1,300	8,500
Montreal	1,850	500	270,000
St. Catherines	700	100	20,000
Collingwood	850	75	1,600
Thunder Bay	125	50	6,200
Vancouver	1,100	1,500	70,000
Victoria	1,200	450	5,200

Sources: Dominion Bureau of Statistics
Department of Manpower and Immigration
Canadian Shipbuilding and Ship Repairing Association

Notes: 1. The shipbuilding employment data for Vancouver relate to all yards in the area.

2. The shipbuilding employment data refers to marine activities only. Significant employment in industrial activity is also provided by yards in the St. Lawrence Region and to a lesser extent elsewhere.

3. The shipbuilding employment data for Halifax and Victoria excludes the naval dockyards.

the level of employment in all activities by all the yards in the industry was less than four-fifths of the average employment in the peak year 1966. With the marked decline in new construction, the level of employment in marine activity (excluding industrial work) in Association yards decreased even more sharply, to less than 60% of the average for the year 1966. The December 1969 marine employment figure in Association yards was the lowest monthly figure since the early 1950's.

Employment in the shipbuilding and ship repair industry in Canada as a whole is a relatively small component in total employment; in 1966 the number of wage and salaried personnel in the industry were 1.2% of those in all manufacturing industries. The shipbuilding industry is a significant provider of work in certain areas, however; Table C-37 records employment information for the main shipbuilding localities on the basis of data from the Dominion Bureau of Statistics, the Department of Manpower and Immigration, and the Canadian Shipbuilding and Ship Repairing Association. It may be noted that the data for shipyards in the localities relate to employment in marine activities only (shipbuilding, repair and conversion), and do not include employment on industrial work carried out in shipyards. To the extent that such work is done, shipyards are a more significant centre of employment in a locality. Brief comments on individual situations follow.

Halifax

Shipyard employment in Halifax in late 1969 was about the same as in 1966 and was sone 15% of employment in all manufacturing in the area. When the level of shipyard activity declines, workers are reported to wait for an improvement rather than to move to other occupations or areas. Some younger yard workers have left the industry for construction when laid-off.

Saint John

Employment in shipbuilding and other marine work in Saint John at the end of 1969 was substantially higher than in 1966 and was over 20% of total employment in all manufacturing industries in the area. General shipyard labour does not move in response to lay-off, but skilled technicians and labour can and do go elsewhere.

Quebec

The number of workers employed in shipbuilding and other marine work in the Quebec area toward the end of 1969 was only one-third of that in 1966; one of the two yards closed in 1968 and the volume of activity is down. The importance of the remaining yard in the local employment situation is not fully reflected by the data in the table, since the data for all manufacturing relates to the Quebec metropolitan region and embraces the activities primarily of small firms producing mainly non-durable

products. Shipbuilding is one of the few metal fabricating activities in the area and is the major employer in Lauzon. Shipyard workers who are laid-off normally wait for resumption of work. There are few alternative occupations for them in the area and although some movement to Sorel occurs, this is temporary only.

Sorel

Employment in shipbuilding and other marine work in late 1969 was slightly below the 1966 level and was 15-20% of total local employment in manufacturing; a similar amount of employment was provided by the industrial work carried out in the shipbuilding establishment in Sorel.

Montreal

Employment in shipbuilding and marine work in Montreal in late 1969 was only one-third of that in 1966. One repair yard closed in 1967; the other yard ceased shipbuilding during 1969 and now carries on ship repair work only in conjunction with industrial work. The employment is a small part of total manufacturing employment in the Montreal area.

St. Catherines

Employment in shipbuilding and other marine work is a comparatively small part of total manufacturing employment in St. Catherines, even when shipbuilding activity is above the very depressed level at the end of 1969. Workers are reported to be mobile between shipbuilding, motor vehicle, and other

manufacturing plants in the area, which includes St. Catherines, Welland, Niagara Falls, Fort Erie and Port Colborne. At the end of 1969 the yard obtained an order for two ferries for Prince Edward Island, and this will result in increased employment early in 1970.

Collingwood

The shipbuilding industry is more important in the employment situation of Collingwood than its depressed condition at the end of 1969 indicates. When the yard operated at a high level, as in the mid 60's, it was employing perhaps one in two of the workers in local manufacturing industries. After lay-off, workers do not move from Collingwood but wait for activity to recover. A recent order for an upper laker will result in increased employment in the yard early in 1970.

Thunder Bay

Shipbuilding and ship repairing in Thunder Bay is reported to be no longer a significant steady employer. No ships have been built for several years but conversion of freighters to self-unloaders has provided several hundred jobs each winter for the last five years, the workers being seasonally laid-off from other jobs. Ship repair provides employment to a variable extent, depending on the nature of the work.

Vancouver

Employment in shipbuilding and other marine work in Vancouver was greater at the end of 1969 than in 1966, but is a small part of total employment in manufacturing in the area.

Victoria

Employment in shipbuilding in non-Government yards in Victoria late in 1969 was one-third that in 1966. One yard closed at the end of 1967 and activity at the other declined. The Department of Manpower reports that many workers have obtained employment at the Esquimalt dockyard, where activity has increased, or have moved to work in other manufacturing industries. A number of skills are transferable and shipyard workers are now less dependent on shipbuilding than formerly.

The above information indicates the importance of shipbuilding as a source of employment in major shipbuilding centres. Yards located in smaller towns have also been most important in their local employment situation. It is desirable to examine in closer detail the costs involved in supporting these levels of employment.

As the earlier discussion indicated, the readily identifiable cost element in assistance programmes for the shipbuilding industry is the subsidy paid on commercial vessels and trawlers. The total amount of subsidy paid in 1961-62 to 1968-69 was $235 million, of which some one-half has been calculated to be protection equivalent to that for other industries and one-half has been subsidization as such.

TABLE C-38

CANADA

SUBSIDY AND EMPLOYMENT IN MAJOR CANADIAN SHIPYARDS

	Subsidies Paid 1962-63 to 1968-69	
	Total Paid	Total per Man-Year of Employment
	$ Million	$
Atlantic		
Halifax Shipyards	$ 14.5	$ 1,810
Ferguson Industries	7.2	3,170
Saint John Shipbuilding	20.0	1,980
Average, Atlantic	$ 41.7	$ 2,050
St. Lawrence		
Davie Shipbuilding	$ 38.9	$ 3,030
Geo. T. Davie	11.3	2,810
Marine Industries Ltd.	12.0	1,280
Canadian Vickers	13.4	1,300
Average, St. Lawrence	$ 75.6	$ 2,070
Great Lakes		
Port Weller Drydocks	$ 20.9	$ 4,990
Collingwood Shipyards	27.8	4,450
Average, Great Lakes	$ 48.7	$ 4,670
Pacific		
Burrard Drydock	$ 4.4	760
Yarrows Limited	12.4	2,450
Victoria Machinery Depot	13.8	3,490
Average, Pacific	$ 30.6	$ 2,070
Average, Major Canadian Yards	$ 196.6	$ 2,390

Sources: Department of Industry, Trade and Commerce; Canadian Shipbuilding and Ship Repairing Association.

Notes: 1. The employment figures relate to shipbuilding, repair and conversion activity only, and exclude industrial employment.
2. Calendar year employment has been related to fiscal year subsidies for shipyards that accounted for over 80% of total subsidies of $235 million.

Information is available on the amount of subsidy paid to individual yards and this can be related to yard employment to obtain an indication of the cost of supporting these jobs. The result of doing this is shown in Table C-38, but interpretation of the data must recognize the great importance of the mix of ships built in individual yards and whether these ships were financed by subsidy or use of proceeds. Yards that were more heavily engaged in commercial and fishing vessel construction would record a higher value of subsidy per job than yards in which government work, conversions and repairs were more important. Similarly, use of proceeds rather than subsidy would affect the apparent cost per job.

Despite these limitations, evaluation of subsidies in relation to employment does provide an indication of the local and regional, as well as the national, effects of the assistance programme. Table C-38 shows total subsidy disbursements in 1962-63 to 1968-69 and the average amount of subsidy per man year of employment over that period, for twelve yards that carried out a very large part of the new construction and received over 80% of the total subsidies paid. The employment data from which subsidy per man year is calculated refers to direct labour in building, repair and conversion, plus a proportionate share of indirect labour and overhead salaried personnel; it does not include employment in the yards on industrial work, which would be attributable as a benefit arising from subsidy to the extent that a yard might not have carried on any work - building, conversion, repair, industrial - in the absence of subsidy.

The table shows a considerable variation in subsidy per man year of employment from yard to yard because of the influences already mentioned, but a similar value on average in the Atlantic, St. Lawrence, and Pacific Regions at just over $2,000 per man year. In the Great Lakes Region, where over 80% of new construction in the period was in dry cargo vessels to which subsidy was applicable, the value was higher, at over $4,500 per man year. The national average was some $2,400 per man year.

Recalling the earlier finding that one-half of subsidy was protection, the data indicates that the average actual subsidy cost per man year of employment has been about $1,200 during 1962-63 to 1968-69. In the recent years of the period, when subsidy rates for both commercial and fishing vessels have been declining, this average subsidy rate would be lower, but evidence on this is obscured by declining construction activity and employment and by a greater use of proceeds from disposition rather than subsidy in financing new ships.

The great significance of shipbuilding as a source of employment in certain areas - the Atlantic, St. Lawrence, and Upper Lakes - and the average actual cost of subsidy per man year of employment there (about $1,000 in the Atlantic and St. Lawrence regions and some $2,250 in the Upper Lakes) is to be viewed in the context of the industrial and employment development programmes which have recently been introduced by the Department of Regional Economic Expansion.

The purpose of the Regional Development Incentives Act is described by the Department as being to create new job opportunities in regions of slow economic growth, and the programme provides capital incentives to industry for manufacturers establishing, expanding or modernizing plants in designated regions.

The present regions, designated for a three year period to July 1, 1972, include all of the Atlantic Provinces (except Labrador), eastern and northwestern Quebec (including Lauzon but not including Sorel and Montreal), northern Ontario (not including the Georgian Bay area), areas in the Prairie provinces, and parts of interior British Columbia (not including the coast).

For a new plant or new product expansion the incentive is up to 25% of capital costs plus up to $5,000 for each job created in the operation, provided the total benefit does not exceed $12 million, or $30,000 for each job created, or one-half of the capital to be employed in the operation.

Materials

As was shown in Table C-20, shipbuilding and ship repairing uses relatively less materials than the average of all manufacturing industries (44% compared with 57% of sales). This is associated with a higher degree of labour utilization and indicates that the shipbuilding industry gives rise to relatively less employment indirectly, through purchases from other industries, and relatively more directly.

An important factor in materials usage by the industry is the extent to which its requirements are satisfied from within

Canada's productive resources or are imported, but little information has been readily available on the domestic and import content of materials used. The recently formed Canadian Association of Marine Equipment Industries were unable to develop data regarding this. The Dominion Bureau of Statistics publishes statistics on materials used in the industry and also reports, separately, imports of steel, machinery and other commodities in varying degrees of detail. Unfortunately, these data relate to product imports for use in all industries; no information is available on imports for use in particular individual industries and the input-output work which has been done nationally and provincially is for selected single years only and is not detailed enough by industry to be useful in this respect.

In redognition of this problem, the questionnaire sent to yards asked them to report the Canadian content in their material usage in four selected years, 1958, 1963, 1967 and 1969. Responding yards stressed that there was a major degree of estimation in their figures, and they provided information in a form that related Canadian content to their total value of work performed rather than to their value of materials. The following were the responses from questionnaire yards:

	Canadian content as Per Cent of Value of Work Performed			
	1969	1967	1963	1958
Region:				
Atlantic	76%	71%	71%	89%
St. Lawrence	74	83	80	75
Great Lakes	84	78	83	79
Pacific	70	73	77	65
Canada	75	78	79	70

The proportion of Canadian content has been reported to be generally in excess of 70%, with a value of 79% in 1963 (when specific Canadian content requirements prevailed). Subsequently, with cessation of Canadian content provisions, there was some slight decline to 78% reported for 1967 and 75% in 1969.

The Department of Supply and Services provided the Committee with data regarding the material content in certain government vessels that are of recent or current construction. The data, which again contain some degree of estimation, are:

Vessel	Completion Year	Canadian as Per Cent of Total Material Purchases
John Hamilton Gray	1968	63%
Parizeau	1967	48
Limnos	1968	53
Louis St. Laurent	1969	67
Quest	1969	55
Protecteur)	1969	62
Preserver)	1970	
P.E.I. Ferries	1971	50

This information suggests a Canadian materials content of between one-half and two-thirds in these ships, with an average of about 60%. This average may also be applicable more widely to ship-building industry activity as a whole. The value of materials in work performed has been 45% and if 60% of materials are purchased in Canada, the Canadian content in the value of work performed would be some 73% provided all other services are purchased domestically. This corresponds closely to the actual Canadian content reported by questionnaire yards for 1969.

TABLE C-39

CANADA
STEEL PLATE USED BY
SHIPYARDS

Thousand Tons

	Used by Shipyards	Supplied by Domestic Mills	Domestic Supply as Per Cent of Use
1968	98.2	35.3	36%
1967	108.8	46.4	43
1966	105.3	82.3	78
1965	132.3	103.6	78
1964	92.1	90.3	98
1963	91.0	79.3	87
1962	73.4	63.7	87
1961	64.7	58.3	90
1960	56.3	28.6	51
1959	59.0	21.1	36
1958	45.3	11.1	24

Source: Dominion Bureau of Statistics

Information on steel usage is also relevant. Table C-39 shows the steel plate used by shipyards in marine and industrial applications during each year and the tonnage supplied by domestic mills, both as reported by D.B.S. The data are drawn from different sources and may not be on the same definitional basis. Also they do not take account of inventory changes and are thus not a precise indication of Canadian content in each year, although they can be taken as an indication of changes in the level of Canadian content over a number of years.

With the introduction of subsidy and Canadian content provisions in 1961, domestic purchases of steel rose sharply, both in absolute terms and as a per cent of total usage, and remained at a high level through 1966. Termination of Canadian content under the revised subsidy arrangements was followed by a substantial drop in the position of domestic steel in 1967, and this decline continued in 1968.

Since steel usage in shipyards in recent years has been only about 13% of the value of all materials purchased by the yards, the decline in the domestic content of steel cannot be taken as indicating the magnitude of a general decline in the Canadian content of all material and equipment purchases. The data does illustrate, however, some downward tendency in domestic purchases by Canadian shipyards.

One other effect from the revised policy arrangements of the mid-60's should be noted. The removal of the duty drawback provisions caused Canadian shipyards to concentrate their imports of dutiable materials in the U.K. because of the much lower British Preferential duty rates. Accordingly the source of supply has been effectively narrowed, and delivery and prices from the U.K. to Canada are not always as good as those to other countries. It might be noted that Canada is an exception among shipbuilding countries in not providing duty drawback on imported components, according to the Economist, March 1968; in particular, Canada's chief competitor in supply of ships - the U.K. - provides duty drawback to its shipbuilders.

The changed policies of the mid-60's have also had an effect from the point of view of suppliers. Thus, whereas the shipbuilding industry took over 10% of the steel industry's domestic shipments of plate in each of the years 1962, 1963, 1964 and 1965, by 1968 that percentage had dropped to 3.5% and, as the earlier table showed, the decline was from 104,000 tons in 1965 to 35,300 tons in 1968. In this connection, it is worth noting the concluding remarks of the Chairman in the Tariff Board Report, Reference 139, under which duty free import of steel for shipbuilding was continued.

> "In many countries, as well as Canada, the shipbuilding industry is assisted in a number of ways and the particular problem of the steel producers might be re-examined to determine if some measure beyond the scope of this enquiry could be adopted to encourage the use of Canadian steel by shipyards located on the St. Lawrence, in British Columbia and in the Maritime Provinces without, at the same time, increasing costs to the shipbuilders."

TABLE C-40

CANADA

EXPORTS AND IMPORTS OF SHIPS AND BOATS

	IMPORTS		EXPORTS	
	No.	$Million	No.	$Million
1968	41	$ 13.4	737	$ 2.3
1967	52	5.3	681	1.8
1966	93	22.0	100	1.5
1965	195	5.8	160	1.1
1964	100	1.8	131	5.8

Note: Pleasure and sporting craft are not included in the data.

Imports include lifeboats, other boats, dredge hulls, launches, ships, commercial fishing ships.

Exports include fishing boats, lifeboats, floating dry docks, dredges and parts, hulls, gillnetters, ships, ships sold for scrap, trawlers.

As regards suppliers of other materials, earlier analyses have indicated the relatively limited scale of the shipbuilding industry in Canada and the dispersion of its activity over a wide range of ship types. This has meant, from the suppliers' point of view, that the market for individual components or items of equipment has been limited, and often too small to support manufacture in Canada. The earlier attempt to encourage Canadian manufacture through the Canadian content regulations has been abandoned.

In summary, the information which has been developed suggests that some 60% of the materials used in shipbuilding have been of Canadian origin in recent years, with 40% imported. While the proportion may change from year-to-year with changing supply and competitive conditions, it would appear that - in relation to 1967 materials usage totalling $130 million by the industry - some $80 million was supplied from domestic sources and $50 million was imported.

Balance of Payments

Besides balance of payments implications arising from imports of materials, there are direct effects deriving from the import and export of ships themselves.

Table C-40 records the information available on trade in ships in recent years. As indicated in the footnote, the data relates to a variety of ship and boat types and the large number of vessels recorded indicates that trade was normally in smaller sized vessels.

The recorded sizeable trade values in certain years were primarily connected with transfer of flag on older ships. There has been little effective import and export of new ships in recent years.

During the period shown in the Table, the rate of subsidy for non-fishing commercial ships declined from 35% in 1964 to 25% in 1968. Whether imports of ships will become more significant in future depends on circumstances yet to be seen. The subsidy rate, after being 25% for three years, began to decline at 1/2% per quarter after May 1969. However, any effect arising from the reducing rate of subsidy has not yet been experienced because of the few ships that have been ordered during the recent depressed conditions in the Canadian market for shipping services. Nor is it expected that the effect of the reducing rate of subsidy will be evident in the immediate future, since resumption of orders on any sizeable scale is unlikely to occur for some time. When it does, and should business be placed abroad rather than in Canadian yards, the balance of payments effect will be an indication of the value of the economic activity - in terms of employment, material purchases from domestic sources, profits, and taxes - that will be lost to the Canadian economy.

While not directly related to the costs and benefits of shipbuilding assistance, data on the balance of payments situation for shipping services may be of interest.

The information for shipping services between Canada and the United States through the St. Lawrence Seaway and the Great Lakes is as follows:

TABLE C-41

CANADA

BALANCE OF PAYMENTS

OCEAN SHIPPING

1948 - 1968

$ Million

	Receipts		Expenditures		
	Operations of Canadian Ships	Expenditures by foreign Ships in Canada	Expenditures abroad of Canadian Operators	Payments to foreign ships for carriage of imports	Balance an Ocean Shipping Account
1968	195	110	186	237	(118)
1967	193	112	177	213	(85)
1966	179	100	175	210	(106)
1965	169	93	176	203	(117)
1964	162	80	161	174	(93)
1963	139	74	150	184	(121)
1962	125	72	130	175	(108)
1961	113	67	130	164	(114)
1960	103	55	114	157	(113)
1959	92	48	107	146	(113)
1958	103	43	96	113	(63)
1957	128	44	113	108	(49)
1956	136	48	104	105	(25)
1955	115	45	95	77	(12)
1954	82	35	67	66	(16)
1953	82	41	60	75	(12)
1952	102	43	64	71	10
1951	100	40	60	76	4
1950	70	38	38	66	4
1949	93	40	44	50	39
1948	125	48	51	46	56

Service: Dominion Bureau of Statistics

Note: Receipts from Operations of Canadian Ships includes:
- gross earnings on exports
- charter operations
- shipping between foreign ports

Inland Freight By Vessels
Between Canada and the United States

	$ Million		
	Receipts	Payments	Balance
1968	$ 47	$ 28	$ 19
1967	43	24	19
1966	44	33	11
1965	38	27	11
1964	38	31	7
1963	30	29	1
1962	28	27	1
1961	21	23	(2)
1960	21	24	(3)
1959	22	25	(3)
1958	14	17	(3)
1957	18	21	(3)

Canada was in deficit with the United States in the late '50s on payments for shipping in the Lakes and St. Lawrence. With the changed trading conditions which gave Canadian ships access to carriage of ore to the United States, and with the growth and modernization of the Canadian fleet during the 1960's, this deficit became a surplus which recently has approached $20 million.

As regards deep-sea shipping, the Canadian ocean-going fleet is now of negligible size. Data on the Canadian balance of payments for ocean-going shipping may nevertheless be of interest, and is shown in Table C-41.

Balance of payments data for ocean shipping measure the following:

- receipts arising from Canadian operated ships, including gross earnings in carriage of exports, earnings from charter operations, and earnings in cross trading between foreign ports

- receipts arising from expenditures by foreign ships in Canadian ports
- expenditures abroad of Canadian operations, including charter payments
- payments to foreigners for carriage of imports to Canadian ports.

It may be noted that such data does not embrace all shipping transactions, but only those with balance of payments effects.

The course of developments in the ocean shipping account has been in several distinct stages. In the conditions of the late 1940's, when Canada had a sizeable deep-sea fleet and world ocean shipping was disrupted, Canada had a surplus on ocean shipping account. During the 1950's, as the Canadian-owned fleet ran down and world shipping recovered, the surplus changed to a deficit that by 1958 was $63 million. The main component of the change was increasing carriage of Canadian imports by foreign ships. Canadian operators continued to function, but increasingly as charterers rather than as owners.

The opening of the Seaway in 1959 brought about a higher level of deficit on ocean shipping account. Carriage of Canadian imports by foreign ships continued to increase, and along with that the expenditures by foreign ships in Canada. Canadian operators expanded their chartering activity markedly, as indicated by both their receipts and payments abroad. The net effect was that the level of over all deficit on ocean shipping account has shown no change in trend, but has fluctuated around a level just over $100 million per year.

The foregoing data regarding the balance of payments for inland and ocean-going shipping services is to be viewed in the context of Canada's overall deficit on goods and services, which in recent years has been:

	$ Million
1969	(801)
1968	(111)
1967	(499)
1966	(1,162)
1965	(1,130)
1964	(424)

Indirect Effects

It is generally agreed that assessment of the benefits from an activity should recognize fully the primary effects, in terms of purchases of materials and services, provision of employment, and rewards to management and capital. Moreover balance of payments effects should also be taken into account when alternatives are present of domestic production or imports.

Beyond this there is the matter of the secondary effects which flow from the basic components of activity. These comprise the purchases, incomes and employment which are induced throughout the economy and which are referred to as income or employment multiplier effects. At one time it was considered that measurement of such effects was extremely important in benefit/cost work, but more recently this view has been modified for several reasons.

Such multiplier effects commonly occur, since they arise from almost any aspect of economic activity. What should be measured, therefore, is the differential multiplier effects that might