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Maine's Deep Water Harbors

Maine Department of Economic Development

Joseph B. Coffey

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MAINE'S DEEP WATER HARBORS

FEB 10 1982

Prepared for

MAINE DEPARTMENT OF ECONOMIC DEVELOPMENT

by

Joseph B. Coffey
INTRODUCTION

In charting Maine's future growth, we must consider the multiple goals of our society and balance efforts to solve both social and environmental problems.

The protection of our environment deserves and is being given the highest priority by Maine people, and even greater strides will have to be made in the future if we are to reduce and control pollution.

Despite the relative affluence of the United States, Maine has serious problems of unemployment, poverty, housing, health and education. If we are to solve these problems great effort will have to be made to achieve a sound growing economy.

In attempting to achieve our multiple goals, we must look beyond emotional appeals and chart logical and scientific directions. There are many directions which development in Maine can take. Some, which would appear to advance our goals, are suggested herein.

James K. Keefe
Commissioner
FOREWORD

Until modern times, man’s survival throughout our evolution on this planet was solely a product of how well we could master nature. The wilderness was an enemy to be conquered by early man. He was threatened both by natural forces that had to be overcome and by physical isolation.

In Maine, as in all the new world, the physical expansion of farms, industries and towns and an increasing population were encouraging proof that the new pioneer society would survive and flourish. It was only logical that we came to think of progress in terms of economic growth and that anything standing in the way of progress, especially nature, could be dispensed with.

Today, however, growth can no longer be the sole consideration. Man has all but won our war with nature and is now beginning to vanquish it. The explosion of the first atomic bomb is symbolic of our conquest and the present degree of environmental pollution is a measure of how far along the road we have come towards annihilating our former enemy.

In our relationship to nature, we are supermen when compared with our ancestors. But, as with all our freedoms, in exercising these new powers, we must undertake new responsibilities.

In this, the last third of the twentieth century, we have come to a general realization that our survival on spaceship earth depends as much on the maintenance of the entire ship (protecting its natural ecological systems) as on the actual nurturing of its first class passengers (providing man’s energy needs). Failure to fulfill either one of these responsibilities will destroy us.
The people of Maine have a fortuitous opportunity to accomplish both these objectives. History, while dealing meagerly with us in terms of economic development has, ironically, endowed us with a relatively unspoiled environment.

At a time when in other parts of this country, the neon lights glare ever brighter and the miles of pavement wind ever onward, the precious chance to escape to the solitude of an unspoiled forest or an untamed river can still be found in Maine.

If we use imaginative planning, we will be able to maintain and enhance this environment while supplying the growing economic demands of ours and future generations.

It is in response to this challenge that the Maine Department of Economic Development has created its 'Development Through Conservation' policy. Our goal is not the victory of growth, but the survival of man: not economic development at the expense of environmental quality, but both economic development and environmental quality.

It is my sincere hope that the following study will aid us in achieving this goal.

Joseph B. Coffey
Augusta, Maine
March 11, 1971
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This study is not meant to be definitive. It is a review of certain demands facing Maine and potential opportunities to help fulfill these demands through a more ambient use of the sea.
CONCLUSIONS

1. Of all possible locations for a liquid or dry bulk deep water terminal and/or redistribution center on the East Coast of the United States a location in Maine would offer several outstanding and exclusive advantages:
   
a) Maine has the natural attributes for such a deep water terminal. Excepting Maine, no state on the east or gulf coasts of the US has deep enough harbors to accommodate the largest bulk vessels now afloat.

   b) Our site locations, with depths to 100 feet, require little or no dredging, thereby offering the lowest capital costs and necessitating the least amount of ecological interference of all possible locations.

   c) A redistribution center in Maine can supply all US East Coast ports, utilizing for shuttle delivery and pickup, the maximum size ships or barges each port is now handling without costly port improvements.

   d) Even if a proposal using artificial islands were developed, building an island to serve the northeast in lieu of a terminal on the Maine coast would not seem economically sound.

2. Maine’s involvement in any large container operations would of necessity have to be linked with transhipment. Our present level of imports and exports are too meager to warrant large facilities.

3. Maine is eminently situated for the location of a major container terminal and/or redistribution center as:

   a) It is in close proximity to principal trade routes of the world and is on the great circle route to Europe.

   b) It is close to northeast and midwest markets via its rail, air and highway systems.
c) It has congestion-free deep water harbors.

4. A container terminal located in either Casco Bay or Penobscot Bay would potentially have:

   a) A water-rail interface with an east-west axis via the Canadian National in Portland and in Searsport, via the Bangor and Aroostook to the Canadian Pacific at Brownville Junction.

   b) A water-air interface with both east-west and north-south axis via Bangor International Airport which is becoming a major alternate airport and via Portland International Airport which, although having international airport status, isn’t being used as one at present.

   c) A water-water interface via a feeder service to east coast ports, Gulf Ports, Puerto Rico and the Caribbean. Although US flag ships would have to be employed in a feeder service originating at a US port and serving other US ports, the ability to pickup as well as discharge cargo destined for other US ports and the vastly greater opportunities for backhaul would effect economies which could tend to offset the advantages of foreign flag ships out of Halifax. Another economy may exist in employing seagoing tugs and barges. Also relief may be available under the Merchant Marine Act of 1970.

5. The effect of having a bulk redistribution center in Maine will be the location in the state of large stockpiles of raw materials, some of which, presumably, could be purchased at cheaper prices. This could attract industries which use these materials to locate here.

6. The effect of having a container redistribution center located in Maine would be to provide the state with a tool for economic expansion. We would be in a position to attract industries to port related industrial parks, free from congestion and high location costs, but with the transportation links of major US ports.
7. Canadian ports have an advantage over US ports in that their governments are participating in the financing of container terminals and deep water bulk dredging and unloading terminals.

8. Regional Development Plans to insure development through conservation would be a valuable asset to each industrial park plan. These should be propagated in such a way as to involve adoption by the planning boards of each community in the region.

RECOMMENDATIONS:

1. The Division of Science and Technology of the Department of Economic Development should compile and publish a companion volume to this study which lists and gives the physical characteristics of Maine's Deep Water Harbors.

2. A transportation and physical distribution consultant firm should be engaged by the State or one of its agencies to determine econometrically, the best way to develop container shipping in or through Maine.
THE MASTER MARINER

VISION

The mystery of these magic words! They fell
In hopeful pride from young New England lips:
"Follow the sea!" He visioned stately ships
He sailed as master-mariner: the spell
Cast by old Triton's long; since muted shell
He took him up; he saw the tidals rips
By rough shores race; the blue Gulf Stream that slips
Through Arctic seas the towering berg that dips
And rises, rainbows on its turret-tips.

In school in drowsy aftnoons of spring
The dull walls fade; for youth dreamed his dream
Of moving waves, of ocean's restless stream
With tall ships all its might encompassing!
He heard the chanty that the bronzed men sing
When sails slide up—grow taut—the words supreme,
"Anchors aweigh!" Then like a long white seam
The wake of silver foam forever following—
From the masthead high, he sees his colors gleam!

Half-bred, he heard the tales of sailor-men
Retold to cronies old. Great deeds of might
When sharp-bowed clippers rivaled birds in flight,
—We shall not look up on their like again—
Belying sails whose towering clouds of white
Mocked at the wind-waves in their misty den
To bring back Eastern bales beyond folks' ken.
The race from Hong-Kong decks to Frisco, when
They led the flying jib—world-cheering then!

The singing shores belind him, home you! went
On roads that were but lanes thro' green.
Above he saw the northern stars serene,
And swinging slowly t'ro its arc, the Dipper sent
Its message for the mariner's content.
Then home shores faded; on dusky sheen
He dreamed the Southern Cross in its demesne
Touched inky waves with edges crystalline,
And saw dim shores he called the Orient!

REALITY

These boyhood dreams went with the man full-grown
Who trod his deck between the sea and sky;
Might in his rigid lip, his dauntless eye,
The course he steered his realm; the ship his thro' he.
The child-like people marvelled at his ringing tone,
And cowered as they stammered their reply;
Strange god he seemed to them as he strode by—
Life gave all strength to him; he stood alone
And answered every ringing challenge, "Aye, i' ye!"

He knew the fretted minaret; he heard
The temple bells their jangled music make;
Bazaars; the charmer with the hooded snake.
He bartered with Byzantine and with Kurd;
He loaded pitch from Trinidad's queer lake;
He saw the slaughter of the Pampas herd;
He drove his ship where Cape Horn's currents rake,
Where Golden Gate its tidal waters slake,
And anchored when the dripping fogs had blurred

He knew the thrill of greeting when a shade
Rose clear above the ocean's rim, and grew
A towering ship that swept within his view,
Sole. Passed; and vanished down the lanes of track.
At on the forward path his course was laid,
And strength and speed were hers, good ship and true,
So proudly came to port, her journey through,
Where tossing flags bright spots of color made,
And took her place in the commerce cavalcade.

Ald life was buoyant as his ship rode in
And bowed when clanking chain and anchor fell;
He felt her breath of peace as she rode the easy swell
O' harbor waters; he heard once more the din
That told of men and busy marts wherein
His world was making bid to buy and sell.
And here he heard the news there was to tell
Of Bill, and Joe, and Jake; "Of Brad?"... "Well!
We know he sailed. That's all the news that's been.'

He loved the cool grey seas that did his will,
The ramping wind that made the rigging shriek,
And dashed salt spray above the ship's high beak.
Power was his to cope with strength and skill
When treachery walked his deck to work him ill.
He mustered his men on quarter; they heard him speak:
"We therefore commit his body unto the deep?"
Such times he dreamed of home and kin, but still
There was the ship's clean leap to sails that fill.

RETURN

In dreams he saw it plain, his homestead white,
Built on a hill four-square to winds that blow;
He smiled in thought at its "windowed cuplow"
Ablaze to greet both dawn and sunset light.
To the east the towered-lamp guarded by night,
To the west, green trees in serried row on row.
Old cronies, after supper, footing slow
Make the wharf; benches, pipes alight,
And lads "a-playing boat" in a tiny bight!

So thro' the dam of his story still crept
Slowly but sure, the sleeping stream that brought
Bit by bit for wider breach, until it brought
The flooding waves that ever homeward swept;
And self-surprised, one day, alert, he kept
Into his native paths; once more he sought
The sources of the things which wisdom taught;
Man's homing instinct to the letter kept—
Life's morning called him. Other times were naught!

By ANNA E. COUGHLIN

ROCKLAND, MAINE

1944
I. ECONOMIC DEMANDS FACING MAINE

Each year many Maine people leave the State to live elsewhere. Some of the migrants are elderly people leaving to take up retirement life, some leave for another climate, but the bulk of those leaving do so for lack of suitable general employment opportunities within the State. Many of these people are young graduates of Maine high schools, trade schools and colleges, and the social investment our State has in them in terms of talent and education is tragically lost to us. Unfortunately, there are simply not enough jobs created in Maine each year to keep our native talent at home.

Traditionally six basic industries were the foundation of Maine’s economy. These were: Lumber and Wood, Paper, Transportation, Textiles, and Food. During the early days, extensive capital investment was made in these industries and, as a result, the entire economy of Maine grew rapidly.

At various times during Maine’s history, production in the transportation (ship-building) and textile industries topped all other states in the nation. Because of their great scope, these six industries supplied the bulk of Maine’s manufacturing jobs for many years. In more recent times, however, employment in these industries has declined.

This decline is not simply a reflection of some nationwide trend. Ownership of these industries has largely passed into out-of-state hands, and many of the top management decisions which create or fail to create jobs are made by these individuals. Apparently, as nationwide employment in most of these industries is increasing, most expansion money involving increased employment is being channeled into states other than Maine.

If greater year-to-year employment growth is assumed desirable for Maine,
then we must look for and promote sources outside Maine's traditional big six.

Presently we have a deficit of 3,000 new jobs per year over and above the demands of our growing labor force. By 1975, unless we can turn the tide, this deficit will have doubled to 6,000.

Our present unemployment situation is appalling. At least 30,000 or our people are unemployed and possibly more.

In addition to an employment deficit, Maine workers suffer from an income gap. Maine's per capita income in 1969 was $2,625 - $149.00 higher than in 1968. Although per capita income in Maine is increasing, the average per capita income of the New England States is increasing even faster and, thus, creating a larger gap between the two. The reasons for this trend are involved but generally relate to economic productivity and differences in the types of jobs created in Southern New England as compared with those created in Northern New England. Southern New England has a large proportion of capital intensive industries paying higher salaries, while Maine has a large proportion of labor intensive industries paying lower salaries.

For purposes of this study: A labor intensive industry is one in which there is low capital investment and/or low productivity per worker. It generally has a large number of workers, but pays low wages. Examples of labor intensive industries in Maine are the Food Industry, The Lumber and Wood Industry, The Apparel Industry, The Leather Industry, The Fishing Industry and The Tourist Industry. A capital intensive industry is one in which there is a high capital investment and/or high productivity per worker. It generally pays high wages to a small number of workers per single plant or operation. However, it is a Building Block for other industries, both capital intensive and labor intensive. Examples in Maine of capital intensive industries are the Paper and Allied Products Industry, The Petroleum and Coal Products
Industry, and The Transportation Equipment Industry.

Thus, the primary requisite for a healthy economic future in Maine is a large increase in the number of new jobs being created by attracting more capital to the State, the greater portion of which should be invested in capital intensive industries.

With this goal in mind, the Maine Department of Economic Development is in the process of creating economic growth centers throughout the State in the form of industrial parks.

Plans are under way for the development of Project Woodchip, an industrial park located in Northern Maine to further utilize our natural forest resources.

The Maine Life Science Park to be located near Pineland Hospital will take advantage of the resources of the Biomedical Research people who exist in the hospitals and colleges of the communities in the Lewiston-Brunswick-Portland triangle.

The Penobscot Marine Industrial Park concept is the result of an evaluation of current trends in World Transportation in an attempt to further harness one of our traditionally great natural resources--The Sea.
II. TRENDS IN OCEAN SHIPPING AND THE USE OF DEEP WATER HARBOURS

Within the last few years, the international transportation of cargo has undergone the most significant change since steam replaced sail.

Bulk cargo is now being transported in 200,000 ton shipments and non-bulk general cargo is being containerized and shipped through intermodal networks in unprecedented volumes and at breakneck speeds.

As bulk ships get larger, the number of world ports capable of handling them gets smaller. With the exception of Maine, no state on the east or gulf coast of the United States has deep enough harbors to accommodate the largest bulk vessels now afloat.

As the volume of container traffic increases, congestion in our large city ports is so hindering intermodal transfers it has caused the transportation industry to look to the possibility of creating alternate port facilities in areas with adequate rail, truck and air service away from the major cities. Maine's closeness to Northeast and Midwest markets via its rail, air and highway systems coupled with its congestion free undeveloped deep water harbors make it a logical choice for location of a major U.S. container terminal and/or redistribution center.

BULK CARGO TRENDS

Twenty years ago, there were two basic types of ships carrying liquid and dry bulk commodities on the oceans: the 16,000 Dead Weight Ton, 2 tanker and the general workhorse dry bulk tramp, mostly 10,000 DWT World War II built Liberties. These small general purpose ships have largely disappeared from the oceans of the world today and have been replaced by a profusion of highly specialized types — automobile carriers, wine tankers, L.P.G. and L.N.G. tankers, molten sulphur carriers, cement carriers, heavy
lift ships, belt conveyor self-unloaders, phosphoric acid tankers, woodchip carriers. 'Fairplay', the International Shipping Journal, periodically issues a supplement listing all the new-building vessels on order in the world -- the code that accompanies this list now identifies 158 separate specialized vessel types.

Car carriers, conventional ship hulls with huge 'barns' for a superstructure, are now in service which can carry as many as 3600 cars. Specially designed woodchip carriers, are being built to carry 100,000 tons of woodchips per cargo from Brazil to Japan. Some 24 liquefied gas tankers (LNG carriers) are under construction which will carry natural gas, liquefied under refrigeration. Some of these ships will carry 120,000 cubic meters of liquid methane and will cost over $50,000,000 to build in Europe or Japan. The conversion factor of liquid methane to gas, is 600 to 1.

Many bulk ships -- specialized and otherwise -- are now used in dedicated service or as the Japanese so colorfully describe it -- piston service -- shuttling back and forth with one commodity between just two ports on a long-term contractual basis.

In place of the old king posts and burtoning system for cargo handling, some bulk ships are now equipped with gantry cranes, whirley cranes, belt conveyor systems, bucket elevators, rotary plows, air slides, screw conveyors and Sauerman scrapers. The belt conveyor unloading system originated on the Great Lakes and it is there it has reached its highest state of use and perfection. One new 50,000 DWT lake self-unloader is under construction with a designed discharge rate of 20,000 tons per hour.

Another recent development is the evolution of large sea-going tugs and unmanned barges. The first generation of this equipment came into service about eight years ago with tugs of no more than 3500 HP towing
16,000/17,000 DWT barges on hawser. "pushing only in rivers, or protected waters. Although there was a great saving in capital investment and manning costs, there was a severe off-set as frequently the average speed obtained in the open sea was 7 knots or less. The second generation of tugs/unmanned barges provided tugs of 5000 to 6000 HP, barges of up to 26,000 DWT and designed with hardware to permit the tug to stay in the notch pushing outside in light to moderate seas, generally over half the time while offshore.

These units average close to ten knots at sea. The third generation of tugs and unmanned barges now under design and construction could represent the real breakthrough -- tugs up to 11,000 HP, barges of up to 35,000 DWT of special patented design with a rigid or articulated connection to permit the tug to stay "in the notch" or pushing configuration 100% of the time. Designers of this equipment expect to get average sea speeds of 12 to 14 knots in seas of up to force 7 weather. Shortly some of these new designs will come into service and if they are as successful as their designers and proponents claim -- much of the coastwise traffic of the United States and Canada can be expected to switch to units of this type.

Combination ships are literally pouring from the world's shipyards. The OBC, (Ore/Bulk/Oil) carrier is a triple purpose ship. It is strengthened to permit carriage of cargo in every other hold when carrying dense cargoes such as iron ore, capable of loading a full deadweight cargo of oil, designed with sufficient cubic capacity that if all cargo holds are utilized the ship can carry a full deadweight cargo of the lighter bulk commodities -- bauxite, coal, and grain. The ore/oil carriers, on the other hand, have very limited cubic capacity and are designed to carry only full deadweight cargoes of iron ore or oil.

Some of the larger ships are employed carrying oil from the Persian Gulf to the Atlantic Basin and return to the Pacific with iron ore for
Japan. Today, however, most of the combination ships are trading exclusively as tankers as the tanker market is considerably stronger than the dry bulk market.

Slurry carriers are another bulk transportation innovation in a class apart. The transportation of dry bulk in slurry form pioneered by the Marcona Corporation has reached the stage where slurry carriers are now being built and converted to carry iron sands from New Zealand to Japan and iron ore concentrates from Peru to the West Coast of the United States and Japan.

The slurry carrier for all practical purposes is a tanker -- connect the pipes, start the pumps, and the cargo goes over the side. The heart of the concept is ship-board, de-watering and re-slurrying. The slurry, containing about 75 percent solids, is prepared by application of water under high pressure through jets installed in the floor of storage bins or tanks. From storage it is pumped by pipeline into the vessel's hold, where, almost as quickly as the solids settle, the water is decanted, usually by pumping. The result is a nonshifting cargo with a moisture content of 5-10 percent, not any higher than some conventional direct shipping ores. When the ship arrives, the cargo is re-slurried with either fresh or salt water and pumped out.

By transporting dry bulk commodities such as iron ore concentrates, sulphur, coal, salt and potash in slurry form, the advantages of off-shore loading/discharging through an underseas pipeline as tankers can do is also possible for these ships. In addition, with slurry, the very substantial capital investment in shoreside loading and discharging facilities can be obviated on new projects and no stevedoring is required.
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<td>Libya</td>
<td>34'</td>
<td>35,000</td>
<td></td>
</tr>
<tr>
<td>Bombay</td>
<td>India</td>
<td>34'</td>
<td>35,000</td>
<td></td>
</tr>
<tr>
<td>Boston</td>
<td>USA</td>
<td>40'</td>
<td>60,000</td>
<td></td>
</tr>
<tr>
<td>Buchanan</td>
<td>Liberia</td>
<td>42'</td>
<td>65,000</td>
<td></td>
</tr>
<tr>
<td>Chaguaramas</td>
<td>Trinidad</td>
<td>40'</td>
<td>60,000</td>
<td></td>
</tr>
<tr>
<td>Chicago</td>
<td>USA</td>
<td>27'</td>
<td>15,000</td>
<td></td>
</tr>
<tr>
<td>Dampier</td>
<td>Australia</td>
<td>51'</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>Duluth</td>
<td>USA</td>
<td>27'</td>
<td>15,000</td>
<td></td>
</tr>
<tr>
<td>Esquível</td>
<td>Jamaica</td>
<td>31'</td>
<td>28,000</td>
<td></td>
</tr>
<tr>
<td>Fawley</td>
<td>England</td>
<td>43'</td>
<td>80,000</td>
<td></td>
</tr>
<tr>
<td>Finnart (Clyde)</td>
<td>Scotland</td>
<td>100'</td>
<td>200,000</td>
<td>Depth sufficient for 500,000 d.w.t. ships</td>
</tr>
<tr>
<td>Galveston</td>
<td>USA</td>
<td>44'</td>
<td>80,000</td>
<td></td>
</tr>
<tr>
<td>Genoa</td>
<td>Italy</td>
<td>49'</td>
<td>110,000</td>
<td>Further deep water berth under construction</td>
</tr>
<tr>
<td>Halifax</td>
<td>Canada</td>
<td>70'</td>
<td>300,000</td>
<td>Further deepening to 39' and 66'</td>
</tr>
<tr>
<td>Hamburg</td>
<td>Germany</td>
<td>36'</td>
<td>45,000</td>
<td></td>
</tr>
<tr>
<td>Houston</td>
<td>USA</td>
<td>40'</td>
<td>60,000</td>
<td>Deep water jetty for 100,000 d.w.t. ships, nearing completion</td>
</tr>
<tr>
<td>Immingham</td>
<td>England</td>
<td>38'</td>
<td>55,000</td>
<td>Limited depth in port. Off-shore terminal</td>
</tr>
<tr>
<td>Kuwait</td>
<td>Kuwait</td>
<td>75'</td>
<td>320,000</td>
<td></td>
</tr>
<tr>
<td>Le Havre</td>
<td>France</td>
<td>53'</td>
<td>120,000</td>
<td>Further deepening in progress</td>
</tr>
<tr>
<td>Liverpool</td>
<td>England</td>
<td>51'</td>
<td>£00,000</td>
<td>Partly laden 200,000 d.w.t. tankers accommodated</td>
</tr>
<tr>
<td>London</td>
<td>England</td>
<td>47'</td>
<td>95,000</td>
<td></td>
</tr>
<tr>
<td>Los Angeles</td>
<td>USA</td>
<td>40'</td>
<td>60,000</td>
<td></td>
</tr>
<tr>
<td>Maracaibo</td>
<td>Venezuela</td>
<td>41'</td>
<td>65,000</td>
<td></td>
</tr>
<tr>
<td>Marseilles</td>
<td>France</td>
<td>41'</td>
<td>65,000</td>
<td></td>
</tr>
<tr>
<td>Marseille-Fos</td>
<td>France</td>
<td>66'</td>
<td>210,000</td>
<td></td>
</tr>
<tr>
<td>Milford Haven</td>
<td>England</td>
<td>65'</td>
<td>20,000</td>
<td>Blasting &amp; dredging planned for 300,000 d.w.t. ships</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Contd.</td>
</tr>
<tr>
<td>Port</td>
<td>Country</td>
<td>Limiting Depth of Water (Approaches)</td>
<td>Approx. size of ship d.w.t.</td>
<td>Comments</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------</td>
<td>--------------------------------------</td>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Mocamedes</td>
<td>Angola</td>
<td>56'</td>
<td>160,000</td>
<td>Further deepening impossible</td>
</tr>
<tr>
<td>Moengo</td>
<td>Surinam</td>
<td>24'</td>
<td>15,000</td>
<td></td>
</tr>
<tr>
<td>Montreal</td>
<td>Canada</td>
<td>35'</td>
<td>35,000</td>
<td></td>
</tr>
<tr>
<td>New Orleans</td>
<td>USA</td>
<td>40'</td>
<td>60,000</td>
<td></td>
</tr>
<tr>
<td>New York</td>
<td>USA</td>
<td>45'</td>
<td>80,000</td>
<td></td>
</tr>
<tr>
<td>Norfolk</td>
<td>USA</td>
<td>45'</td>
<td>80,000</td>
<td></td>
</tr>
<tr>
<td>Panama Canal</td>
<td>Panama</td>
<td>41'</td>
<td>65,000</td>
<td></td>
</tr>
<tr>
<td>Philadelphia</td>
<td>USA</td>
<td>40'</td>
<td>60,000</td>
<td></td>
</tr>
<tr>
<td>Port Arthur</td>
<td>Canada</td>
<td>27'</td>
<td>15,000</td>
<td></td>
</tr>
<tr>
<td>Port Cartier</td>
<td>Canada</td>
<td>40'</td>
<td>60,000</td>
<td></td>
</tr>
<tr>
<td>Port Etienne</td>
<td>Mauritania</td>
<td>23'</td>
<td>65,000</td>
<td></td>
</tr>
<tr>
<td>Portland</td>
<td>USA</td>
<td>45'</td>
<td>90,000</td>
<td></td>
</tr>
<tr>
<td>Puerto la Cruz</td>
<td>Venezuela</td>
<td>38'</td>
<td>75,000</td>
<td></td>
</tr>
<tr>
<td>Puerto Ordaz</td>
<td>Venezuela</td>
<td>38'</td>
<td>75,000</td>
<td></td>
</tr>
<tr>
<td>Rotterdam</td>
<td>Holland</td>
<td>53'</td>
<td>170,000</td>
<td>Further deepening to accommodate 225,000 d.w.t.</td>
</tr>
<tr>
<td>Safi</td>
<td>Morocco</td>
<td>23'</td>
<td>23,000</td>
<td>Deepening to 45' by 1980</td>
</tr>
<tr>
<td>Saint John</td>
<td>Canada</td>
<td>30'</td>
<td>24,000</td>
<td>165,000 d.w.t. can now be accommodated</td>
</tr>
<tr>
<td>Sept Iles</td>
<td>Canada</td>
<td>38'</td>
<td>60,000</td>
<td>Further deepening to 45' by 1980</td>
</tr>
<tr>
<td>Sfax</td>
<td>Tunisia</td>
<td>36'</td>
<td>45,000</td>
<td>Further deepening possible but unlikely</td>
</tr>
<tr>
<td>Suez</td>
<td>Egypt</td>
<td>40'</td>
<td>65,000</td>
<td></td>
</tr>
<tr>
<td>Sydney</td>
<td>Canada</td>
<td>44'</td>
<td>80,000</td>
<td></td>
</tr>
<tr>
<td>Tampa</td>
<td>USA</td>
<td>34'</td>
<td>35,000</td>
<td></td>
</tr>
<tr>
<td>Toledo</td>
<td>USA</td>
<td>27'</td>
<td>15,000</td>
<td></td>
</tr>
<tr>
<td>Trieste</td>
<td>Trieste</td>
<td>55'</td>
<td>160,000</td>
<td></td>
</tr>
<tr>
<td>Tubarao</td>
<td>Brazil</td>
<td>48'</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>Vitoria</td>
<td>Brazil</td>
<td>36'</td>
<td>45,000</td>
<td></td>
</tr>
<tr>
<td>Weipa</td>
<td>Australia</td>
<td>33'</td>
<td>30,000</td>
<td>Possible deepening for 70,000 d.w.t.</td>
</tr>
<tr>
<td>Yokohama</td>
<td>Japan</td>
<td>36'</td>
<td>45,000</td>
<td></td>
</tr>
</tbody>
</table>
SUPERSHIPS

But now we come to the really revolutionary aspect of shipping, both liquid and dry bulk, -- the size of the ships now being built. As recently as 1967 there was only one ship in the world over 200,000 DWT -- the IDEMITSU MARU, and 28 other ships over 100,000 deadweight tons. At the present time no fewer than 255 tankers and 36 dry bulk carriers or combination ships of over 100,000 deadweight tons are in service. There are an additional 250 tankers of over 150,000 DWT and 130 dry bulk carriers or combination carriers of over 100,000 DWT under construction or on order. By 1974 there will be a massive fleet of close to 700 ships in service of over 100,000 DWT. Over 375 of this fleet will be in excess of 200,000 DWT. Not one of these 700 will be able to arrive or depart fully loaded from any existing berth on the U.S. East or Gulf Coast.

One port -- Norfolk -- is talking about a dredging program that will increase the channel depth from 45' to 55'. That ten feet will take ships that can load full cargoes of coal at Norfolk from about 70,000 deadweight tons at present to possibly twice that size, -- but that won't do it. Today, no new steel or aluminum plant, oil refinery or petrochemical complex heavily dependent on large volume overseas crude or raw material movements should be built at coastal locations having less than 65' and preferably 90' or more depth in the approaches and berth. The days of 35, 40, and even 55 foot channels, where really large volume seaborne bulk movements are concerned, are gone.

It is conservatively estimated that some 50 loading and discharging ports in the world are now able or are being readied to handle 200,000 to 350,000 ton carriers. Five of these are in Canada -- Seven Islands, Quebec; Come-by-Chance, Newfoundland; Mispec Point, New Brunswick; Roberts Bank,
British Columbia; and Port Hawkesbury, Nova Scotia -- but not one such project is underway in the United States.

THE BACKGROUND TO THE USE OF LARGE SHIPS

Industrial development based specifically on deep water ports and large ships is relatively new. It has come about as a result of the increased scale of operations in certain industries necessitating the input of very large quantities of raw materials. At the same time the source of these raw materials is frequently far removed from the centres of processing and consequently transportation costs are heavy. It has been found that the use of very large ships can reduce transport costs significantly and at the same time provide industry with the size of shipments it requires for large scale operation. The growing use of large ships depends upon a number of developments in both the technological and commercial fields.

BIG SHIP TECHNOLOGY

The two main features of big ship technology which must be taken into account in any consideration of future trends in size of ship are: the dimensions and the method of propulsion.

DIMENSIONS: The biggest single restricting factor on large ship development has been draught which has hitherto been governed mainly by port and approach channel considerations, but which is now being influenced by the depth of some of the major world shipping channels such as the Straits of Dover and Malacca. As ship sizes have increased, potential port and channel restrictions on draught have generally resulted in increase in beam relative to length compared to smaller ships.
PROPULSION: The trend towards greater beam dimensions mentioned above naturally results in increased resistance to propulsion. But the extent of this increase has been minimized by the development of bulb and ram bows and of new forms of after body. The increase in resistance can also be partly overcome by the use of larger propellers with slower revving engines which results in greater propulsive efficiency. Increased use of these slower running propellers can however only take place with the development of after body forms which can accommodate them without increased hull resistance.

The question of single or twin screw propulsion for very large ships has been hotly debated in shipbuilding circles in recent years. To date, however, single screw propulsion has continued to be used for all but a very few of the largest tankers mainly because of advantages in propulsive efficiency and in capital costs. Nevertheless gradual improvement in the propulsive efficiency of twin screw vessels is likely to lead to the general introduction of twin screws in tankers substantially above 200,000 DWT. Moreover twin screw propulsion on ships of this size can materially affect maneuverability and thus be of some advantage for movements into and out of ports.

No radical development in ships engines has been required for large ships, both the large, low speed diesel engine and the steam turbine are considered as satisfactory even for very large tankers. Improvements in turbo-supercharging of the diesel engine and in the application of re-heat to steam turbine machinery have enhanced the attractiveness of these types of engines in terms of fuel economy. Nuclear powered ships still remain unacceptable to ship owners in terms of both capital and fuel costs despite the higher power output now required for very big ships.

Technological developments in both the above fields have an important influence on the future of the super-carrier particularly with regard to factors such as safety at sea and in port, vibration, cargo and ballast.
Dimensions of Oil Tankers

TONNAGE DEAD WEIGHT IN TONS OF 2240 lbs (1016 KG)

SOURCE: Hydraulic Laboratory Delft
capacity and dry-docking and repairs. Whilst a margin of safety and circumspection has to be observed at present with regard to these points, it is clear that further progress can only be made once sufficient experience has been gained of the operating characteristics of the very large tanker or dry bulk carrier. Before this experience has been gained and properly evaluated it is impossible to forecast with any degree of accuracy future developments in ship size.

II A. BULK COMMODITY MOVEMENT

Traditionally industry has been based on local sources of raw material. However, in the industrialized countries of the West many of these sources e.g. of iron ore, are rapidly becoming worked out after more than a century of exploitation; or changes in technology and discoveries of higher grade materials at a cheaper price have resulted in the growing import of raw materials from alternative sources. The reluctance of manufacturers to tie themselves to any one source of raw material has also played a part in reducing their reliance on local raw materials.

In the case of those materials which are less evenly distributed around the globe e.g. oil, bauxite, etc., there has been a distinct trend in recent years towards processing within the major markets rather than at source, mainly as a result of cost savings obtained by transporting large quantities of raw material rather than a fragmented pattern of manufactured products in lower volumes. At the same time, manufacturing close to the market allows manufacturers greater flexibility of production schedules and enables them to improve their services to customers.

That this is so, is confirmed not only by the growth of world trade as a result of the general increase in prosperity among the developed nations, but also the increasing length of hauls in the case of particular commodities.
such as coal and iron ore. Thus, the volume of seaborne trade of the six main commodities, excluding oil, increased by 50% from 1960-66 whereas the corresponding increase in ton-miles amounted to 82%.

ECONOMIES IN TRANSPORTATION COSTS

With the carriage of commodities over greater distances, transportation costs account for an increasing proportion of the delivered cost of raw materials to industry and economies in transport costs become important. Over the past decade, there has been a growing realization of the potential cost savings which can be achieved through the development of more efficient methods of transportation.

In the shipping world, advances in welding and pre-fabrication techniques, the development of high tensile steels and improvements in hull design and methods of propulsion have enabled larger ships to be built at lower unit capital and operating costs. Originally initiated by Japan with her aggressive shipbuilding industry and rapidly developing economy, these techniques are now widely practised in Europe and the trend towards larger ships has received impetus as a result of the closure and continued political uncertainty surrounding the future operation of the Suez Canal.

The most dramatic increase in ship size has taken place in the tanker trades mainly as a result of the growth in petroleum demand in Western Europe and Japan. Furthermore the growth in the world fleet of large tankers has mainly taken place over the past decade.

SCALE OF OPERATIONS

This factor is of course closely linked with the type of industry and the size of markets. Because of the nature of the raw materials and the
large quantities involved, users of large ships are confined to primary manufacturing or processing industries. To date the trend towards the use of ships in excess of 50,000 DWT has been almost exclusively confined to two industries: petroleum refining and steel production. In both of these the optimum scale of operation is of the order of 5 to 7 million tons of end product per annum and it is at this level that the industries concerned have found the use of ships above 80,000 DWT to be justified. At lower plant capacities the increased cost of storage and/or capital tied up generally outweighs the savings in transportation and together with the large investment required for the terminals does not justify the use of such large ships unless arrangements can be made for some form of common purchasing policy (e.g. BISC (Ore) - the iron ore purchasing agency for the U.K. steel industry) and/or the use of transhipment facilities to serve a number of processing plants as Gulf Oil have done at Bantry Bay in Ireland. Naturally, the size of operation is similarly important at the port of origin.

The size of the manufacturing or processing facility is in turn related to the size of the markets to be served. In practice this means the local or 'home' market must take the major proportion of output since, despite the Kennedy Round, the high level of import duties in the three main areas of consumption - USA, Western Europe and Japan - effectively prevents the importation of large quantities of manufactured products. Exceptions to this occur only in free trade areas and it is noteworthy that the large processing facilities now coming into operation around Rotterdam have been made possible by the formation of the EEC, which provided Holland with a much enlarged 'home' market.
PORT AND ROUTE LIMITATIONS

Restrictions on choice of port and route are an increasingly major consideration in determining the use of 'super carriers'. Provision of suitable ports of loading and unloading require major investments which can only be justified where one or more very large trade flows are involved. These flows may be of single commodities such as iron ore and oil or a mixture of commodities in cases where the throughput of each commodity is not sufficient to justify the use of super carriers and investment in appropriate handling facilities.

While there are a number of ports throughout the world capable of accommodating ships of up to 80,000 DWT, there are as yet very few ports which are suitable for the ships in excess of 100,000 DWT, which are now coming into service. Attention is being given to development of such ports but the number of locations is limited by the depth of water available in the most suitable places.

In general, facilities for very large ships are well developed at oil loading ports in the Persian Gulf and at the ore ports in Australia, Canada, West Africa and South America. However, while most of the oil ports in the Persian Gulf are capable of handling tankers above 90,000 DWT, among ore ports only the Canadian port of Sept Iles is presently able to accommodate super carriers.

Receiving ports for large ships are at present even less numerous and apart from Japan, only Rotterdam, Le Havre, Trieste, Milford Haven, Fawley, and Finnart in Europe, and Portland, (Maine), and Halifax, and Port Hawkesbury (Nova Scotia), and Mispec Point (New Brunswick) in North America have suitable facilities though many more are planned.

So far as routes are concerned, the Panama Canal is not suitable for
MAJOR DEEP WATER PORTS with ROUTE LIMITATIONS for SUPER-CARRIERS

Rotterdam
Clyde
Milford Haven
Bantry Bay
Le Havre
Lisbon

Golfe de Fos
Trieste

KEY
- inaccessible to carriers > 300,000dwt
- inaccessible to super-carriers
- deep
- water ports

Roberts Bank / Vancouver
Port Cartier & Sept Iles
Halifax
Puerto la Cruz
Japan
Port Dampier
ships over 30,000-40,000 DWT and future deepening is considered hardly possible. The Suez Canal if eventually re-opened can take fully laden tankers of about 70,000 DWT, and 225,000 DWT tankers in ballast; there are plans for widening and deepening the channel but the investment required from outside sources is unlikely to be forthcoming in view of the unstable political situation. Other route restrictions affecting ships of 300,000 DWT and above include Cape Horn and the Magellan Straits where the frequent gales are considered likely to impose severe hull stresses, the River Plate estuary, the Baltic and Southern part of the North Sea, the English Channel and the approaches to New York, all of which offer insufficient draught.

II B. U.S. PROBLEMS AND PROPOSALS

DREDGING

There are many problems involved in locating a deep water terminal in the U.S. In any proposed U.S. East Coast location (except Maine) extensive dredging and/or land reclamation would be required which, in all probability would adversely affect the ecology of the area, thereby incurring massive opposition from conservationists and others.

PORTS COMPETITION

No one coastal area of the United States wants to see a competing area syphon off all deep draft ocean traffic by being favoured with a deep draft terminal. The history of the channel deepening program on the U.S. East and Gulf Coast is one of continual competition between the ports to get sufficient congressional appropriations to permit their port to “keep up”. If Baltimore gets a 50 foot depth, then every other large East Coast port
wants the same depth or greater. In order to get the required funds appropriated, congressional representatives must agree to reciprocal agreements whereby for support of their dredging project they agree to dredging projects in other coastal districts. The financial and ecological problems that an all ports dredging program of this magnitude would produce, are infinitesimal. Therefore, it will be very difficult for any U.S. congressional delegation to get funds to dredge one super-port which not only will draw bulk tonnage away from other U.S. ports but which will, in all probability, serve as a growth center for new industrial activity.

ARTIFICIAL ISLANDS

A proposal has been made recently to build 3 or 4 man-made islands in deep water along the U.S. East coast to serve as regional offshore redistribution terminals. However, this is not believed to be a viable proposition as the cost of constructing 3 or 4 such off-shore terminals, each with duplicate facilities, would be prohibitive and the potential bulk volume necessary to get the unit cost of transfer down to an acceptable level would not justify more than one such terminal on the North American Seaboard.

Nevertheless the Federal Maritime Administration, late in 1970, made a request for proposals by consulting firms for the evaluation of off-shore terminal concepts, ‘To develop more effective and economical ways to enable U.S. ports and ship operators to overcome the draft limitations which now prevent the use of larger, and hence more economic, bulk carriers in appropriate trades; and to do this in a way which minimizes pollution hazards’.

In January 1971, Zapata Norness Inc. of Houston, Texas, proposed private development of an artificial island terminal in Delaware Bay at
an estimated cost of $160 million dollars. The island would be 300 acres composed of material dredged from the bottom of the bay.

The company has completed the preliminary design, engineering and environmental studies necessary for the development. The company has formed a subsidiary, Zapata Bulk Systems Inc. to build and operate the proposed terminal, three to four miles off the shore of the middle of Delaware Bay near the mouth of the Mispillion River.

The first stage of the terminal operation would handle export coal with incoming iron ore shipments to begin in the late 1970's. Plans call for an initial capacity of 20 million tons of coal annually.

The Wall Street Journal says preliminary discussions about major financing are being held with domestic and foreign industrial interests who would benefit from the project and who have indicated they may wish to participate in the financing.

The Lorneville, N.B. deep water port which is mentioned later in this study, would provide essentially the same service but at a cost of $42 million, nearly \( \frac{3}{2} \) less than the island.

Under the plan, coal would be transported in 75,000 ton shuttle ships from Hampton Roads to the terminal to await shipment to Japan on carriers of up to 300,000 tons.

The shuttle run would be 750 miles to Lorneville and 160 miles to Delaware Bay. The shuttle vessels would transport between 10 million and 20 million tons of coal annually to a storage depot on the island.

**MONO-MOORING BUOYS**

A proposal has been made to handle liquid bulk cargo such as oil by employing a coastal system of mono-mooring buoys connected to shore
installations by means of underwater pipelines. Buoys of this type are in use 14 miles off Kuwait by Gulf Oil and 4,000 feet off Mispec Pt., New Brunswick by Irving Oil. Irving's is the only one of its kind in North America. Described as the largest in the world, (its terminal is 55 feet in diameter) it is heated, has foghorns and navigational lights and can be remotely controlled from shore.

Despite these installations, due to political and ecological reasons, large mono buoy terminals will probably never be used on the U.S. coast. They are exposed to more of the elements of the open sea and present far greater unloading hazards than a fixed dock. They are just dangerous enough to provoke large scale legitimate opposition by environmentalists. At a recent hearing in New Jersey, even a group of fifth graders presented a brief against one being installed off the New Jersey coast.

REDISTRIBUTION CONCEPT

A redistribution concept is likely to come into play to handle this apparent bottleneck for North America. Under this concept extremely large vessels -- 150,000, 200,000, 300,000 DWT -- are used for the long sea haul to a redistribution terminal or Central Transfer Station (CTS) as it is also called located at a deep water port. From there smaller shuttle vessels barges or tankers move the final deliveries to other ports along the U.S. Eastern Seaboard.

II C. COMMODITIES

There are many cargoes possible for such a terminal. The commodities that will be regularly transported by vessels of more than 100,000 DWT during the next decade are: oil, iron ore, grain, salt and coal.
There are limitations on the size of ships that will be used for carrying other bulk commodities because of restrictions in: the depth of water at source ports, the interport distance or major routes, and the volume of commodities on each route.

OIL

Since 1961, the total world tonnage in oil has exceeded dry cargo. The prototype for an oil redistribution operation is the Bantry Bay, Ireland terminal established in 1968 by Gulf Oil Company. Here, six 325,000 DWT tankers owned by D.K. Ludwig, the largest ships in the world at present, bring oil from the Persian Gulf to Bantry Bay via the Cape of Good Hope. Former "supertankers" of 70,000 to 90,000 DWT are assigned the on-carriage from Bantry Bay to the Gulf refineries and customers in Europe and the United Kingdom. The big 325,000 DWT tankers arriving at Bantry Bay draw 81 feet fully loaded. The shuttle tankers making final delivery draw 40 to 50 feet.

IN NOVA SCOTIA

Gulf Oil Canada Ltd. is in the process of setting up a similar type of operation at the Strait of Canso. It has a 60,000 barrel a day refinery about to go on stream with a deep water fixed dock built by the government of Canada capable of handling the largest supertankers afloat or planned.

If processed at the point of entry in sufficient quantity, oil imports can justify the use of super carriers and the accompanying development of deep water port facilities on their own. Once the facilities are in existence, they then become potential redistribution centers depending on their geographic location. The Gulf refinery at the Strait of Canso
and the Newfoundland Refinery facility at Come-By-Chance, Newfoundland have been planned on this basis.

The Gulf refinery will receive its crude oil requirements by tankers of up to 2.4 million barrels capacity. The Strait of Canso offers a natural ice-free harbour and a deepwater wharf for year-round oil deliveries by tanker.

Careful long-range planning went into the choice of location and design of the refinery. Recognizing the potential of the Strait of Canso area, Gulf Canada (then British American Oil) began assembling land over 12 years ago. Periodically, the economics of building and operating a plant at Point Tupper were reviewed. A study of the area by Canadian Bechtel, commissioned by Gulf Canada in 1966, outlined the opportunities for a large scale, low-cost petroleum refinery and source of petro-chemical feedstocks for industries that could be expected to build in this area in the future.

According to the study, the industrial complex that could be constructed in the Point Tupper area in the next 20 years would require a refinery feed rate of 150,000 barrels per day with about 50,000 b.p.d. of the output serving as feed-stock for manufacturing petro-chemicals and ammonia.

Gulf Canada products will be supplied from the Point Tupper refinery to the company's eight marine terminals in the Maritimes and to markets throughout the Atlantic Provinces and lower St. Lawrence region. The company also has a long term contract to supply petroleum products, as soon as the refinery begins production, to the Nova Scotia Power Commission's new generating plant, next to the refinery site. This plant will buy residual fuel from Gulf Canada, and will supply steam and electricity to Canadian General Electric's heavy water plant, being built in the area.
POINT TUPPER HEAVY INDUSTRIAL PARK
GULF CANADA REFINERY (FOREGROUND)
BACKGROUND, LEFT, N.S. POWER COMMISSION
55,000 KW GENERATING STATION, NOVA
SCOTIA PULP BLEACHED SULPHITE PLANT,
AND GEORGIA-PACIFIC GYPSUM BULK LOADING
PLANT. RIGHT, CANADIAN GENERAL ELECTRIC
HEAVY WATER PLANT, OLD GULF OIL MARINE
TERMINAL AND TOWN OF PORT HAWKESBURY.
A unique feature of the Point Tupper refinery is that all finished products will be blended as they come off the process units, eliminating the blending of batches and the additional pumping and storage capacity normally required for this operation.

Gulf Canada is planning to avoid air and water pollution problems from the outset. The largely air-cooled plant has been designed to use a minimum of water from nearby Landrie Lake, and to re-use it several times. Refinery effluent and oily ballast water from incoming tankers will be stripped of hydrocarbons and other possible contaminants by oil water separators.

A sulphur recovery plant to remove approximately 30 tons per day of hydrogen sulphide from fuel gases before they are burned in refinery furnaces will be built at a cost of $400,000. The sulphur is expected to be sold to other industries on Cape Breton Island.

High efficiency burners will be installed to minimize atmospheric discharges of sulphur trioxide and oxides of nitrogen, and in addition, all refinery relief valves will be vented through a smokeless flare, which provides a pollution safeguard in the event of processing upsets.

Eight crude oil storage tanks, each capable of holding 450,000 barrels, are being built and are among the largest ever constructed. These huge tanks, 57 feet high and 240 feet in diameter, each cover more than an acre. Constructed of special high strength steel approximately an inch and a half thick at the base, these tanks will have a double roof -- a fixed cone roof designed to keep an estimated snow load of up to 6,000 tons off an internal floating roof which is installed for the dual purpose of preventing vapor loss and atmospheric pollution. In addition, eight storage tanks provide capacity for nearly a million barrels of gasoline and naphtha;
ten bunker and gas oil tanks will hold approximately 1.9 million barrels; with six middle distillate tanks holding about 700,000 barrels (and two jet fuel tanks holding approximately 165,000 barrels) for the balance of product storage. Three additional tanks totalling 44,000 barrels will store oily tanker ballast and other petroleum waste for reprocessing.

**GOVERNMENT BUILDS WHARF**

The oil terminal wharf was built by the Department of Public Works of Canada. This dock is the first in the Western Hemisphere capable of handling some of the world's largest ships -- the 326,000 ton tankers in service for the Gulf Oil Corporation drawing an average of 90 feet. It will provide for a draft of nearly 100 feet approximately 750 feet from shore.

An important advantage of locating the new refinery at Point Tupper was the physical makeup of the Strait of Canso. When the Canso Causeway was built in 1955 connecting Cape Breton Island to the mainland of Nova Scotia, it formed a natural harbor 14 miles long which is ice-free in winter and has depths of up to 294 feet. The Strait is wide enough at the south end to allow most ships to turn on their own power, but the largest supertankers, such as Gulf's "Universe Ireland" and "Universe Kuwait", will have to be assisted by tugs.

The Strait of Canso is ideally located near the main sea lanes between the U.S. East Coast and the booming ports of Europe. The Point Tupper refinery will receive low cost crude oil from the major overseas producing areas of South America, Africa and the Middle East, delivered by the most economical means of transportation.
## Advantages of Newfoundland

The following table gives the approximate distance, in nautical miles, from Come By Chance to some principal ports:

<table>
<thead>
<tr>
<th>Location</th>
<th>Distance (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cornwall, Ont.</td>
<td>1,000</td>
</tr>
<tr>
<td>Halifax, N.S.</td>
<td>483</td>
</tr>
<tr>
<td>Montreal, P.Q.</td>
<td>968</td>
</tr>
<tr>
<td>Quebec, P.Q.</td>
<td>839</td>
</tr>
<tr>
<td>St. John, N.B.</td>
<td>749</td>
</tr>
<tr>
<td>Toronto, Ont.</td>
<td>1,272</td>
</tr>
<tr>
<td>Reykjavik, Iceland</td>
<td>1,619</td>
</tr>
<tr>
<td>Antwerp</td>
<td>2,433</td>
</tr>
<tr>
<td>Belfast</td>
<td>2,006</td>
</tr>
<tr>
<td>Dublin</td>
<td>2,077</td>
</tr>
<tr>
<td>Glasgow</td>
<td>2,055</td>
</tr>
<tr>
<td>Hamburg</td>
<td>2,701</td>
</tr>
<tr>
<td>Liverpool</td>
<td>2,149</td>
</tr>
<tr>
<td>London</td>
<td>2,397</td>
</tr>
<tr>
<td>Strait of Gibraltar</td>
<td>2,337</td>
</tr>
<tr>
<td>Baltimore, Md.</td>
<td>1,307</td>
</tr>
<tr>
<td>Boston, Mass.</td>
<td>836</td>
</tr>
<tr>
<td>Brunswick, Ga.</td>
<td>1,681</td>
</tr>
<tr>
<td>Charleston, S.C.</td>
<td>1,525</td>
</tr>
<tr>
<td>Chicago, Illinois</td>
<td>2,109</td>
</tr>
<tr>
<td>Jacksonville, Fla.</td>
<td>1,682</td>
</tr>
<tr>
<td>Miami, Fla.</td>
<td>1,846</td>
</tr>
<tr>
<td>New York, N.Y.</td>
<td>1,044</td>
</tr>
<tr>
<td>Norfolk, Va.</td>
<td>1,224</td>
</tr>
<tr>
<td>Philadelphia, Pa.</td>
<td>1,194</td>
</tr>
<tr>
<td>Portland, Me.</td>
<td>809</td>
</tr>
<tr>
<td>Ras Tanura, Persian Gulf</td>
<td>7,467</td>
</tr>
</tbody>
</table>
Gulf Oil Canada Ltd. has an import quota from the U.S. Department of the Interior and in the event that this could be increased, is in a perfect position to operate a redistribution terminal for North America out of the Strait of Canso.

Canadian oil interests are of the opinion that their import quotas will be increased as U.S. oil shortages grow and, that with the possible exception of Maine, there is little likelihood of a U.S. deep water port being developed in this decade.

IN NEWFOUNDLAND

In Newfoundland, Golden Eagle Refinery has a 13,000 barrel a day refinery located in deep water at Holyrod and Newfoundland Refinery is in the process of constructing a 100,000 barrel a day refinery located in deep water at Come-by-Chance. The $155,000,000 Come-by-Chance operation is 1000 miles from New York and will market 40% of its production in the U.S., none of it coming in under oil quotas. A large part of the production will be bonded jet fuel to be used by international flights out of Kennedy Airport; another part will be residual fuel oil (About 30 percent of the Come-by-Chance production will be sold in European markets, and the remainder in the Canadian home market). Transhipment of Persian Gulf and Libyan Oil to Montreal via a Newfoundland deep water port with onward shipment by tanker is a definite possibility. The Government of Canada has agreed to construct the dock facilities to be used by the new oil refinery at Come-by-Chance. The wharf is estimated to cost in excess of $16 million. It will be built under an agreement providing for the recovery of the federal investment through rentals and user charges over a number of years.
(FOREGROUND) PORT OF ST. JOHN, N.B.
(BACKGROUND) MISPEC PT. ON LEFT WITH CANAPORT AND SUPERTANKER H.J. HAYNES.
CANAPORT-IRVING OIL COMPANY BULK STORAGE TERMINAL AND DEEP WATER PORT,
SEPTEMBER 1970. 212,000 DWT SUPERTANKER H.J. HAYNES SHOWN DOCKED AT MONO-MORING BUOY PRIOR TO DISCHARGING.
The decision to construct the wharf is subject to the successful completion of all other negotiations relating to the refinery project under terms and conditions outlined by the Government of Newfoundland and its negotiations with the Federal Government.

IN NEW BRUNSWICK

In New Brunswick, on the Bay of Fundy, Irving Oil's mono-buoy operation, which has been referred to previously, became the Western Hemisphere's first deep water oil terminal and redistribution center in September 1970 with the unloading of the 212,000 ton tanker, H.J. Haynes in depths of between 140 and 170 feet.

Canaport, as Irving Oil's Mispec Point location is called, was built at a cost of $14 million. It is planned to eventually form part of an interrelated complex with the Port of St. John and the proposed dry cargo deep water harbor (Canport) at Lorneville on the other side of the Bay.

The operations at Canaport will have an immediate effect on the local economy. A $20 to $30 million expansion at the Irving Oil refinery is underway which will increase production from 38,000 to 120,000 barrels a day. The construction force will reach 800. The amount of crude oil available will be an additional incentive for industries to locate in St. John.

The crude is being transported from the Persian Gulf aboard Chevron Oil tankers.

Part of the crude unloaded from super tankers at Mispec Point is already being redistributed to U.S. East Coast ports, via smaller tankers. Expansion of this operation could see Mispec Point become a major redistribution center for North America.
PROPOSED OIL DISTRIBUTION ROUTES
FROM CANAPORT

The Chignecto Canal—The dotted line indicates potential shipping routes through the Chignecto Canal linking the St. Lawrence and Northumberland Strait areas with the Bay of Fundy and the U.S. Atlantic coast. Inset, three possible variants of the Canal are shown: 1. From Cumberland Basin to Baie Verte, along the Miscou River. 2. A waterway along the course of the Memramcook River, and a canal to Shediac Bay. 3. A waterway along the course of the Petitcodiac River, and a canal to Shediac Bay.
Also, transhipment of Persian Gulf and Libyan oil to Montreal via Canaport with onward shipment by pipeline is considered a future possibility.

COAL

U. S. Export coal, particularly for Japan, would be attracted to a deep water redistribution terminal via shuttle ships from Hampton Roads, perhaps as backhaul for ore coming into U.S. ports via the redistribution center.

The proposed Bay of Fundy deep water superport (Canport) at Lorneville, (not to be confused with Irving Oil's Canaport at Mispec Point) on the western edge of St. John, N.B., is already being considered for development in transhipment of U.S. coal to Japan.

Under the plan, a coking coal depot with a capacity of two million tons would be established at Lorneville.

Smaller shuttle vessels would carry coal, mined in West Virginia, to Lorneville to await shipment on larger ships to Japan.

The Norfolk and Western Railway of Roanoke, Virginia, is involved in the plan with Japanese steel interests.

If proceeded with, it will see vessels transporting between ten and twenty million tons of coal annually past the Maine coast to New Brunswick for transhipment.

ORE

Iron ore is now being imported into the United States in greater and greater quantities from Australia, Brazil and West Africa. One recent development in iron ore is that Australian ore is now being sold for delivery
in the Eastern United States, while Eastern Canadian iron ore is being sold on a long-term contractual basis in Japan. This creates the interesting possible shipping anomaly where the big carrier which brings in Australian iron ore to an East Coast redistribution terminal might return to the Pacific with Gulf of St. Lawrence ore for Japan. According to one recent study, transhipment of foreign iron ore to Philadelphia would be cheaper via a deep water port in Canada’s Maritime Provinces... (Probably as backhaul for ships delivering Hampton Roads coal to Lorneville, N.B.) ... then direct shipment in the maximum size vessel which Philadelphia can presently accept.

WHEAT AND GRAIN

Grains have already been travelling in large ships for some time, with some moving in oil tankers. Grains destined for animal feed and certain aid programs in developing countries may travel in general bulk carriers, but higher quality and more valuable grains destined for competitive markets travel in specialized carriers.

Shipping operators are of the opinion that grains will travel in super-carriers, but feel that the maximum size for the foreseeable future will be in the range of 100-150,000 dead weight tons rather than larger. This is due principally to storage and handling problems at ports once the cargo has been discharged. Rotterdam, however, has indicated the possibility of handling grain ships of 200,000 dead weight tons.

U. S. Grain now exported through Norfolk, New Orleans, Galveston, New York, Boston, Toledo, Port Arthur, Duluth and Chicago appears likely to obtain an economic advantage by shipping in super-carriers through a deep water port on the East Coast.
The operation could either involve the use of a unit train to transport the commodity from the growing area to the port, or transhipment via shuttle carriers from current export ports to the deep water port for loading aboard super-carriers.

The success of such an operation would depend to a large extent on the level of rail costs which the commodity would bear and/or the availability of return loads for the ships.

II D. CONTAINER SHIPPING

A principal advantage of container shipping is its adaptability to efficient transfer between different modes of transportation. Containers can be hauled by truck to railroad freight terminals, airports or marine terminals and loaded on flatcars, planes, or ships. No matter where the container is transferred, machinery performs the work with a minimum of manual labor.

Larger and faster container ships, some of which will handle more than 1,000 containers, are now operating. Although these new container ships average only 17,400 dead weight tons, 100,000 ton container ships are under construction.

Airplane designers have plans for huge container planes. Railroads, which have been applying the principles of bulk cargo hauling by operating unit trains for coal, grain and a number of bulk commodities, are making up container trains.

Bulk transportation and containerization greatly reduce the amount of time a ship must spend in port (large breakbulk ships spend approximately half their time in port). Reduced in-port time has made the heavy capital investment necessary for specialized ships economically feasible.
TERMINALS

Container ship terminals, if they are to operate at maximum efficiency, must be designed differently from conventional roofed piers used by breakbulk ships. The Quay Wharf, with powerful shoreside cranes, is the best kind of facility for handling container ships. Wide aprons are needed to provide easy access to the side of a ship for tractors moving containers. Moreover, a container ship terminal needs ample room for assembling containers from overseas for delivery inland and vice versa. Studies have shown that 12 to 15 acres of assembly area per ship berth is a minimum requirement. An average terminal should occupy 50 acres. A container ship terminal should be close to major highways, airports and convenient to trunkline railroads.

In the container revolution fast throughputs demand that the customer take delivery of goods in large blocks. Because of its intermodal nature, all modes of transportation must accept the responsibility to view container transportation in its entirety. This will become even more critical when the domestic use of containers gets under way, the next phase coming up in the industry.

COMPUTER OPERATIONS

An example of the type of international operation that will be the rule of future container shipping is that of the DART Consortium based in Antwerp with 67 million dollars invested in container shipping. Since intermodal transportation from continent to continent is a complex operation, DART maintains a consultant service for its customers. It uses telecommunications and document transmission via private teletype lines to transmit entire cargo manifests from a computer in Antwerp to
Area:
56 acres, paved and fenced.

Dock Face:
1,800-feet with Ro/Ro ramp at northern end.

Cranes:
Two container cranes operate along the full length of the pier on rails set on 51½ gauge. Cranes have cantilever booms on the water side providing an outreach of 113 feet on one crane and 133 feet on the other, with a backreach of 57 feet and 60 feet respectively.

Lifting Capacity: 40 short tons for one crane, 45 tons for the other.

Critical Cycle Time: three minutes maximum.

Unloading Capacity: 1,400 containers per day.

Storage Capacity: 3,650 twenty foot containers.

Rail Service: loop track with four parallel stub tracks inside it. Each of the four tracks will hold 17 container cars.

Straddle Carriers: used to transport containers between storage area, rail tracks and container cranes.

Transtrainers: rubber-tired bridge-type cranes which straddle one track and one row of containers for loading and unloading of rail cars. Transtrainers have capacity of 80,000 lbs., including spreader. Cycle time equals that of container cranes.

Refrigeration: ground storage for refrigerated/heated containers while in storage yard will be provided with quick-connect electrical outlets of 220 or 440 power. A total of 81 positions to provide for 81 refrigerated/heated units of 40 or 20 foot length.
a computer in Montreal on a daily basis. DART also uses computer loading. The consortium policy is to try and be a part of terminal operation in each port it services, both politically and financially.

UNIT TRAINS AND CANADIAN OPERATIONS

Presently, Canadian National Railways is operating 40 hour unit trains from a container terminal in Halifax, Nova Scotia to Chicago. C.N.R. is the most technologically adapted intermodal railroad in North America. When trucking started getting big after World War II, C.N.R. bought into it. The trucking and railroad industries in Canada work much closer together than in the US.

Canadian railroads have very few overpasses and can stack containers two high and move them clear across the continent. With 80 foot long flat cars, four 40-foot containers can be moved on each car, a feat which US railroads can't duplicate without investing prohibitive amounts in rebuilding overpasses and tunnels.

Canadian gateways are the major incentive to the US midwest to get into containerization.

Large volumes of cargo which formerly passed through the St. Lawrence Seaway are now being shipped through Halifax.

When the Port of St. John in New Brunswick opens its container terminal at pier one this April, Canadian Pacific Railways will begin a similar unit train service to the midwest. (CPR tracks pass right through Maine).

HALIFAX, N.S. AND ST. JOHN, N.B.

Both Halifax and St. John are attractive ports. Halifax is presently being served by all the major container lines. They are both in or close
HALTERM, LATE NOVEMBER, 1970
90,000 LBS. GANTRY CRANE AND STRADDLE CARRIER UNLOADING A PART CONSORTIUM SHIP.
to the Great Circle Route, therefore no additional ships are needed to
serve them. They are also safe, operable all weather ports. In the event
that the size of future container ships warrant it, both ports have potential
for deep water development.

CONTAINER SHIPPING COSTS ON DUAL PURPOSE SHIPS

A proposal submitted to the Halifax Port Commission puts forward
the idea of a super-carrier combining the carrying of bulk cargo with
containers. A complete examination of the feasibility of such a concept
would depend upon many factors, but an estimate of the resulting voyage
cost per container shipped across the Atlantic has been made and gives
a figure of $12.5 (US). The assumptions made in deriving this figure
were that a 210,000 DWT bulk carrier with a service speed of 15 knots
would carry 150,000 tons of bulk cargo and 3,430 containers from Halifax
to Rotterdam and a return load of 1,400 loaded containers only. Voyage
costs were allocated between containers and bulk in proportion to the
tonnage of each carried.

For comparison with the costs quoted in the previous paragraph,
this voyage cost per container must be increased by port costs, and by
an allowance for extra capital charges due to the longer voyage time.
This brings it to $30.2 US which is comparable with the $69.5 US for the
present full container service between Halifax and Rotterdam.

A COASTAL FEEDER SERVICE

A container port on an east coast deep water harbor could, of course,
become a water redistribution center with feeder lines regularly operating
between it and major US ports.
A COASTAL FEEDER SERVICE
terminals
Halifax - Jamaica
In showing Halifax's role in containerization we described a rail-water interface with an east-west axis. In an intercoastal service Halifax's role would incorporate a water-water interface with a north-south axis.

The US East Coast contains ¼ of the entire US population. Canadians believe that the penetration of the US East Coast can best be done from Nova Scotia because:

1) The transfer of containers from an international line to an intercoastal line is physically difficult in New York due to New York's already crowded condition.

2) A coastal line originating in a US port would, under US law, have to utilize US flag ships. This could increase costs of moving cargo up to 2½ times. This alone, virtually rules out the use of a US port and makes Halifax the most qualified transfer point.

Although this link is not yet in existence, it is believed that an entrepreneur will appear in the near future.

There could be three alternate routes for an intercoastal feeder service originating in Halifax.

Halifax-US ports - Jamaica: Cargo originating outside US could be delivered along the way. Cargo bound for Jamaica could be picked up at US ports. Since ships wouldn’t be US, cargo couldn’t be picked up in US ports destined for US ports. North-bound freight is not so promising but Pacific to East Coast trade could be served as Kingston, Jamaica has a viable container terminal.

Halifax-US ports as far as Florida: This is not so feasible. North-bound freight would be limited to what the Seaboard Railroad south of New York carries to northern ports for export.

Halifax-US ports - Jamaica - South American ports: This is not feasible as there is too much empty cargo, too much of time, to and from South America.
Under the Canadian plan a coastal operator won't solicit traffic, only the transatlantic company will. Vessels would carry approximately 700 containers. Roll-on, roll-off is very attractive for intercoastal operations. A suitable terminal would cost $\frac{1}{2}$ million dollars.

The cost of transporting a container from Halifax to a typical Southeast out port will be from $85$ to $125$—Nearest price using US ships would be $175$ or more.

A TOOL FOR ECONOMIC EXPANSION

The Halifax terminal is part of the evolution in ocean transportation which doubled between 1950 and 1960 and again between 1960 and 1970. With most major container lines now serving it, Halifax has more shipping traffic insight than facilities.

The Nova Scotia Department of Trade and Industry looks at this new container service as a tool for economic expansion.

Studies carried out by top US transportation consultants show that the economic spin-off from a container port will give Halifax new markets because of new, improved shipping. It will also give Halifax new firms because if transportation links are good new or expanding US firms will forsake the congestion and high land costs of the megalopolis for Nova Scotia.

If Halifax were to become a major coastal redistribution center, it could become an industrial city within 40 years. In order to do this, local management of Halifax container facilities would have to be stressed. Policy making would have to center around Halifax.

Today, the Port of New York is an accessory to the city. This was not always true. It took New York 300 years to travel the cycle of port
city-service city-industrial city.

It took San Francisco only 100 years to travel this same cycle.

Halifax is already in a position where it can sell services to New York and with proper development of potentials created by a coastal feeder service, could travel the cycle in 30 to 40 years.

The next step after developing the port is to create a viable urban core with employment opportunity and a choice of ways to live. The feeder service will possibly generate 40,000 new source jobs in Halifax.

LAND BRIDGE

Although Canadian Railroads are now in a position to operate a Trans-North American land bridge, the entire concept has been held up for some time by big shipping operators with vested interests in current methods of shipping between Europe and the Far East. Meanwhile, new, fast ships being built or planned are eroding away the time saving advantages of the land bridge concept.

AIR BRIDGE

By means of trading off costs in time and warehousing, the seventies will see the air bridge concept of transporting containers from ports to inland destinations applied to high-priced goods in a big way.

The 'Air Bridge' concept goes back to the early 1960's when Flying Tigers stationed an agent in Japan to promote 'Sea-Air' shipments. Sea-Air shipments refers to the movement of goods by ship from Japan to the US West Coast and then by air to destination. The first such shipment was carried from Japan to San Francisco on a Pacific Far East line vessel.
SHOWING WEST COAST WATER-AIR PORTS OF ENTRY.
Top loaded for expeditious discharge in San Francisco, the cargo was specially handled and delivered to Flying Tigers Lines for air carriage to the East. The cargo was delivered to the eastern consignee in about twelve days at a cost much lower than full air shipment. Later, there was a cooperative agreement between Flying Tigers and Lufthansa for on-carriage of Japanese cargo to Europe.

The 'Air Bridge' that American President Lines has established from its ports in the Pacific to inland or east coast points within the United States is another example. The combination of frequent and regular sailings with fast in-transit times, when coupled with expedited discharge and transfer, at West Coast ports to continuing carriage by air freight, has produced what amounts to a new mode of transportation from those Pacific ports to the United States points involved. Depending upon the commodity involved and its density, the tariff rate for performing the service is a figure somewhere between all-surface and all-air. For example, binoculars valued over $600 per ton, with a rate of $13.04 per cwt over 1000 pounds from San Francisco to Kennedy International Airport, combined with a rate of $53.25 per ton (weight or measure) and assuming a density for the commodity of 8 pounds per cubic foot, the actual weight charge from Yokohama or any Japanese port to New York, via sea-air, would be approximately $29.00 per cwt.

The fact that American President Lines has worked out arrangements for through accommodation of standard Air Traffic Association containers carried within one standard 20-foot container, makes it possible to expedite handling and transfer on a very efficient basis. This physical capability, plus special handling procedures, contribute to an overall performance result which can be considered as a new mode of transportation intermediate
to either all-surface or all-air.

The advantages of the approach are obvious, lower cost and fast delivery. Time across the Pacific is now about nine days plus two to three days for the air carriage portion resulting in delivery to consignee's door in twelve to thirteen days. With the advent of a five-day Pacific crossing, which is anticipated in the near future, the "Sea-Air" or "Air-Bridge" concept would cut the time to seven or eight days.

The new Boeing 747-F will be able to move sea containers of up to 40 feet from a West coast port to inland destination. Prior to this, the container, designed for intermodal use aboard a vessel, truck, or railroad has been much too heavy and long for practical use in an aircraft.

Last year, United Airlines carried from the Seattle-Tacoma area three million, six hundred thousand pounds of "Sea-Air" cargo; Flying Tigers Lines, another three million pounds and with the balance carried by other carriers there was a total of about ten million pounds.
COMBINATION CONTAINER AND RO/RO SHIPPING

What containerization has achieved in the carrying of general break-bulk cargo, RO/RO has accomplished for an unlimited variety of wheeled, oversize and heavy lift cargoes.

Roll-on/Roll-off, the name given to the technique of rolling the load on and off specially-built RO/RO ships, is the modern way to ship large, heavy, unusual and sometimes commonplace cargoes that cannot be containerized or that can be better handled by not being shipped in containers.

Depending on the cargo, roll-on/roll-off can eliminate disassembly at the plant site, reassembly at the destination and costly crating and packing. It eliminates risky lifting in slings at the port of loading and discharging. It guarantees inside, under-deck stowage. It offers savings, in time and money.

The roll-on/roll-off concept in transatlantic trade was a direct out-growth of the vision of the founders of Atlantic Container Line, who conceived a modern, efficient cargo-handling service to meet the needs of a broad cross section of shippers engaged in the transatlantic trade. Containerization was part of the answer. The application of the RO/RO principle to large ocean-going ships met the needs of another large segment.

The idea of building a fleet of combination roll-on/roll-off and container ships was revolutionary when first announced. But the founders put theory into practice and, in 1967, the first of the ACL entered service. The ACL fleet has grown to ten vessels and the unique system is now an accepted and important element in world trade.

For the shipper, the RO/RO system offers many advantages that eliminate waste and motion and save time and money.
MACHINERY--RO/RO ships are ideally suited to carrying entire manufacturing units such as textile looms, rolling mills, printing presses, metal working machines and complete sections of manufacturing workshops. By the old fashioned method, these units would have been disassembled, crated and then shipped as separate units. At the destination, crews of highly skilled specialists from the factory would reassemble the equipment. RO/RO saves these valuable man hours in disassembly and reassembly, shipping time, crating expense, plus the ordinary risks inherent in sling loading of delicate machinery.

AUTOMOBILES--Cars for export from the United States are driven directly from assembly plants under their own power or delivered to the terminal by rail or over-the-road truck transporter. At the terminal they are driven into the RO/RO ship's cardecks in a fraction of the time required under the old system of lift and load. A thousand cars can be loaded or unloaded in just a few hours. The system is faster and safer and has resulted in a significant reduction in damage and insurance claims.

AGRICULTURAL EQUIPMENT--The farm equipment industry, utilizes RO/RO for transporting implements of all types and sizes. Corn huskers, loaded seven to the flatbed trailer, are driven directly aboard ship as a single unit. Formerly, each corn husker was lifted aboard and loaded individually. Unit shipments mean savings in handling and damage control. Large equipment is driven aboard under its own power or loaded aboard flatbed trailers depending on the economics of the move.

CONSTRUCTION EQUIPMENT--Earthmovers, trenchers, mobile cranes, bulldozers and road graders are just a few of the many types of heavy duty vehicles that are carried best on RO/RO ships. They arrive at the terminal by truck and rail and can be shipped overseas on Low-Boy trailers or on their own wheels. There are special rates for implements with buckets,
blades and crane booms.

HEAVY LIFT AND OVERSIZE CARGOES--The heavy duty stern ramp and wide open rear gate of RO/RO ships will accommodate cargoes as big as a house and those in the heavy weight class. The Lines assist in the leasing of heavy lift over-the-road equipment that carries up to 250 tons and can be loaded at the shippers plant. The cargo need not be handled again until it reaches the consignee.

In North America, more and more container terminals are being constructed with RO/RO ramps. The terminal in Halifax and Portland International Ferry Terminal both have RO/RO ramps. Atlantic Container Lines operates 18,000 DWT combination roll-on/roll-off and container ships through Halifax and New York. Presently, Portland's RO/RO facilities are only used by the Prince of Fundy but could be used by ships such as ACL if traffic were available.

THE L.A.S.H. CONCEPT

It is too early to tell what impact either the LASH (Lighter Aboard Ship) concept or the Sea Barge Clipper will have on shipping trends. Neither of these concepts were in operation in 1970. The basic difference between the two systems is that the lighters are self-propelled whereas the barges would have to be towed.

According to the March 1971 issue of Transportation and Distribution Management the "S.S. LASH ITALIA", first American-flag lighter-aboard-ship and the largest freighter in the U.S. Merchant Marine, has gone into operation as the first of the five LASH vessels for Prudential-Grace Lines. Each ship will carry 73 lighters with a cargo capacity of 370 long tons.
each, and, because the vessels can discharge while anchored offshore, substantial savings are realized in sailing time. A 15-day, 10-hour trip for the "Italia", for example, would require 28 days, 1 hour for a conventional freighter.
III. ENVIRONMENTAL PLANNING SUGGESTIONS FOR INDUSTRIAL PARK REGIONS IN MAINE

A. MARINE INDUSTRIAL PARK DESIGN OBJECTIVES

The ideal industrial park layout in this State envisions the assembly of a large block of land in a virtually undeveloped area separated from urban areas by distance and/or green belts.

While in most cases, finding these kind of sites will present only a moderate problem; in the case of a marine industrial park, the location of our deep water harbors compounds the problem.

If a large block of land on a deep water harbor can be found in a virtually undeveloped area or in an area that is primarily industrial, it would be ideal. However, because land use patterns along Maine’s coast have developed without much regard for the location of our deep water harbors, more often than not, we will find the ideal sites in current use as residential and recreational areas sometimes combined with light industry and/or light port facilities.

In order to utilize our deep water harbors without disrupting present land uses, or keeping such disruption to a minimum, a corridor connection between a limited deep water port facility and an inland industrial park has been suggested.

Under this plan, a deep water port facility, to handle bulk and/or containerized cargo complete with assembly and staging areas would be located on the coast. This facility would then be connected by a rail, highway and possibly pipeline corridor to a large block of land which would be located in a virtually undeveloped area separated from urban areas by distance and/or a green belt. This would be the site of the marine industrial park proper.
B. LIFE STYLE

Although development of Maine's deep water ports can be a tool for economic expansion, we may well be going backwards if we try to build new cities along our coast. Our 'seers' such as Margaret Mead, Marshall McLuhan and Buckminster Fuller are preaching against the survival of the megalopolis.

Mead is presently making a lecture tour telling young people to go back to the country. McLuhan says that cities will become museums and amusement centers. Eventually, through electronics, man will be able to do most of his work at his home. He also deplores the vast 'waste' of funds being used in highway construction. Soon we will use vehicles not dependent on them. Then we can live anywhere. Fuller envisions us flying around with power packs on our backs in the next decade.

A recent report by the Advisory Commission of Inter-governmental Relations states, '...not only have some of the lagging regions begun to exhibit definite growth tendencies, but the old trend of more and more concentration in the metropolitan area is definitely abating'.

In Maine, properly located industrial parks would allow widespread commuting from our towns and villages. Growth would be distributed throughout these communities instead of being concentrated in one core.

With the creation of the Environmental Improvement Commission, we have guaranteed that industries establishing in Maine will no longer be able to pollute the environment.

However, there are other environmental considerations, many falling in the realm of aesthetics, which we should concern ourselves with in the establishment of regional industrial parks in Maine.
(Much of the following has been adapted from the Strait of Canso Regional Development Plan prepared by the Community Planning Division of the Nova Scotia Department of Municipal Affairs.)

OPEN SPACE

A permanent open space system should be developed intended to:

1) Meet the whole range of recreational needs of residents and tourists.
2) Conserve water and other natural resources.
3) Protect certain areas for future development.
4) Enhance the visual environment of the region.

There should be four categories of open space at the regional level: Permanent, Watershed, Development and Reserve.

PERMANENT OPEN SPACE

Permanent open space is an essential element of any regional development plan. Intended as a permanent feature of the region's development, this form of open space will be used to separate, physically and visually, different parts of the urbanized area. Example: a buffer zone between heavy industry at a Marine Industrial Park and any residential community.

WATERSHED OPEN SPACE

Watershed open space protects the watershed (the runoff area from which the region obtains its freshwater supply, one of its most precious resources) against denudation and pollution.

Since the purpose of a watershed is the production of water, it could theoretically be released for development some time in the future when other
sources of water, perhaps farther out, become available. In the long run, this may happen in certain parts of the watershed as the pressure on its land increases. However, most of the watershed should remain permanently free of development although select cutting with reforestation could be permitted.

Watershed Open Space is different from Permanent Open Space since the watershed, used as a resource to support economic activities, can be manipulated over the years. This difference is emphasized because Permanent Open Space should be considered absolutely inviolate; it has no other purpose than to exist and to offer people an opportunity to see, experience and enjoy a natural environment.

DEVELOPMENT OPEN SPACE

Development open space refers to areas which are developed to a limited extent but are still part of the open space system. The most obvious uses in this category is the developed park and recreational area. Others are cottage and resort developments; quarrying operations; select cutting with reforestation; refuse disposal sites; airport; and utility, railway and road corridors.

The two prime requirements for these uses are to fit into the landscape and not destroy it. The preservation of natural vegetation is essential, and the appearance of a relatively undisturbed environment should be maintained.

RESERVE OPEN SPACE

Reserve open space takes in the remainder of the open space system. Large areas of open space should be kept in solid blocks free of development, not only
for future urban developments but also for possible extensions of the watershed, the permanent open space system, necessary rights-of-way, and airport. Meanwhile, they are available as natural forest areas for fishing, hunting, travel and the general enjoyment of the region's residents.

Permanent open space should surround all urban development. It should also line all regional highways. The Watersheds should also have definite boundaries, established in water development studies. The rest of the region should be designated as RESERVE OPEN SPACE until considerable detailed planning is carried out to designate DEVELOPMENT OPEN SPACE and to indicate it separately.

BEACHES

Available information on the region's beaches must be supplemented with an analysis of the rest of the landscape. Prominent features need to be identified, as well as possible locations for cottage and marina developments and areas for recreation and tourism. Planning of the region's open space system may then be done more realistically, interrelating regional and local considerations.

COMMUNITY OPEN SPACE NEEDS

Urban and regional open space should form one coherent system. Large parks and extensive recreation or sports facilities serve the whole region; smaller park areas and intensive recreation facilities are mainly for residents of individual communities.

Each community needs open space distributed throughout its urban area. Open space offers an often-welcome relief from the man-made hustle and bustle of the urban environment. It makes available scenic areas and important
public places. It helps to define parts of the community so that a resident may easily identify with his neighborhood. And, it provides active and passive recreation areas for use by people, young and old.

The objectives cannot be attained through legislative means alone - by subdivision regulations, for example. Also required are commitments by governments to a firm regional policy for open space, and special efforts on the part of all developers, public and private, to meet these objectives.

The latest residential development techniques must be encouraged to provide a special kind of open space system that meets the foregoing objectives and yet goes beyond them: more open space than would normally be available in a standard subdivision must be provided here, and special attention must be given to preserving scenic and natural areas, if the coastal communities are to maintain a uniquely attractive urban environment. These open spaces, together with parks and schools, should be linked, where possible, to form a network of green open space within the urban areas.

The use of school facilities, utility rights-of-way, and other public or semi-public land for park, recreation and open space purposes should be encouraged.

Areas designated for permanent open space purposes must not be considered as a reserve for later urban uses, and they should not be converted to such uses, unless a strong, overriding public purpose requires the taking of open space land.

Industry today can find power and raw materials at many locations. But, talent - the highly specialized skills of key personnel - is not so easy to find. And so, industries must establish themselves where both the amenity resources (good climate, beaches and recreational facilities) and the social-cultural resources (good schools, libraries and urban attractions) are avail-

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able to talented people who can choose where they are going to live and work.

An industrial park development plan must develop both types of resources. It must place top priority on creating and maintaining an environment of quality that balances the desire of people for urbanity and close communal with nature. This goal can be achieved on the coast of Maine.

ENVIRONMENT

The aim of a regional development plan should be to help create a total environment which will make the experience of living a healthful, pleasant and exciting one.

The plan is concerned with beauty as well as efficiency, and with maximum individual opportunities as well as basic essential standards of public and private services. A quality environment involves social and economic considerations as well as physical ones.

There are two types of environment, natural and built.

NATURAL ENVIRONMENT

In earlier times, the physical expansion of farms and towns and an increasing population were encouraging proof that the new pioneer society would establish itself securely, that it would survive and flourish. The wilderness was an enemy to be conquered by the pioneers who were threatened both by the natural forces that had to be overcome and by physical isolation.

Today, growth is no longer the decisive consideration. Not only this country but the entire world has reached a point at which voluntary population control and wise use of land and resources are essential if civilization is to survive.
Growth alone is no longer regarded as an unmixed blessing. Every valley, every forest, and every water course cannot be developed heedlessly in the name of progress. It is becoming clear that wilderness places are not an enemy but a vanishing resource. As the neon lights glare ever brighter and the miles of paved road wind ever onward, the chance to escape to the solitude of an unspoiled forest or an untamed river becomes more precious.

One of the main aims of a plan should be to protect the natural environment - the earth, water, air, vegetation and scenery - from destruction, spoilation, pollution, and deterioration by development and population growth: not protection for its own sake, but for the enjoyment of this and future generations.

THE BUILT ENVIRONMENT

The built environment is essentially man-designed and man-made. It includes the whole range of physical objects, space relationships, sights, smells and sounds; they can either deaden human responses, creating indifference to the quality of people's surroundings, or nourish people's inborn need for beauty.

The built environment is the result of conscious human choice. In the past, there has been little general concern and action to achieve a good environment. The choice was left almost exclusively to those who commissioned or actually did construction work - those, both in private industry and in governments, with the greatest interest in cutting costs and maximizing profits, not necessarily in the public interest.
Here are a few of the forces that threaten the creation of a quality environment:

1) The notion that construction is progress.

2) The ease with which the bull-dozer can shape and mis-shape natural features.

3) Pre-occupation with traffic and vehicles, to the detriment of people and their living environment.

4) The idea that it is good to segregate land uses absolutely, accepting the often monotonous development that results.

5) The attitude that least cost and highest profit is overriding, producing the view that beauty is desirable but we cannot afford it, or that beauty is a bonus not a necessity.

6) The feeling that if industry and jobs can be brought into an area, everything else will take care of itself.

ENVIRONMENT AT THE PERSONAL SCALE

The built environment exists first at the personal scale: places and things people do and experience.

The siting of buildings and appearance of the neighborhood take on meaning at the personal scale. A drive or walk down a town street reveals the way buildings are designed, how they are related to each other, and how the spaces between them combine to produce a feeling of familiarity and pleasure - or disorderliness, confusion and dislike. Even the smaller objects of the environment - building details such as windows and doors, lighting, street furniture, signs, displays and other visual details - are important since they provide interest and contrast.

ENVIRONMENT AT THE COMMUNITY AND REGIONAL SCALE

The built environment also exists at the larger, community and regional
scale.

It takes continuous civic effort to ensure that new elements to be introduced into the existing environment add to it, improve it and harmonize with it. Governments must provide leadership and guidance on matters of environmental improvement. They must demonstrate, by building quality of design into public buildings, spaces and facilities, that they have a continuing commitment to environmental excellence.

Use must be made of the major elements - a shopping center, and industrial complex, schools and other institutions, the waterfront, highways, parks and other public works - to set examples of good design and to bring out the character of the region and its communities. How can this be accomplished?

1) By carefully structuring the development pattern. The individual resident needs to be able to relate himself to the urban and rural area he is in and to be able to identify with it. Studies of urban areas have proved the importance of orientation. And, in personal experience, everyone knows of towns or cities he likes and where he feels comfortable, and others that produce the opposite effect. The way the major elements of the area are laid out often makes the difference.

At present the regional level, major highways or streets, rail lines, the coast, natural landmarks, and important man-made features such as a shopping center or hospital can serve as points of reference and orientation to the person crossing them. They strengthen his sense of moving through various parts of an area.

At the local level, the individual can gain a sense of orientation and identity, or he can feel lost, depending on the manner in which streets and walkways lead to community activity centers.

At the regional level too, the same effect can result, depending on where the major features of the urban form are located and how they are related. The regional plan is the instrument for making the difference.
Haphazard, sprawl development is the very opposite of well-structured, planned development. Therefore, the prevention of sprawl is not only an important land use and servicing cost consideration but also a basic requirement in the creation of a good regional environment.

2) By the proper location and design of all major environmental elements, not as individual masterpieces, but in harmony with the total scheme of the changing and continuously improving environment.

Example: The design and construction of a water tower. It is one thing to decide that the structure is to be a well-designed, prominent landmark. But it is quite another matter to build a structure which is both well designed and in harmony with the rest of the community, enhancing its total appearance - even if that means sacrificing a unique design for a more suitable and less striking one.

The region needs to establish a mechanism whereby environmental improvement can be ensured. First, a regional landscape study is required, to identify the natural features unique to the region and to recommend how they may be protected and how man-made features may complement them. Then, a review body should be established to advise a regional planning commission on various environmental matters, such as architecture, landscaping, beautification, overhead wiring, outdoor advertising, directional signs, and legal means of assuring that the aesthetic viewpoint is considered. Finally, public and private enterprise must make an advance commitment, to action for a quality environment.

WHAT PEOPLE EXPECT IN THE ENVIRONMENT

Successful economic development in years to come will require industry to be able to attract and hold people.

Why would a top executive, now living in a city in another part of the world, want to come to Maine? Or, why would a talented, young native want
to stay in Maine? What would he expect? What unique features can Maine provide?

No one can answer these questions with absolute certainty. But, it does seem likely that the image of an attractive, smaller community with abundant, easily accessible natural features, clean water and clean air, and a seaside location will be the image in the mind of this person. If he can also receive a comparable salary and be assured of a home at a reasonable price in a good neighborhood with a relatively high standard of community facilities (especially schools) and services, then he is likely to give serious consideration to life in Maine.

These things make up the quality environment. Most of Maine’s coastal communities have many of these things already. Our people have fortunately developed quality environments over the years. As our educational level has increased the desire to maintain our environment has also. Although most of this was done with very little planning per se, it happened to a great extent because of the lack of industrial growth pressure on these communities. However, as this pressure increases, regional planning becomes a necessity.

A major responsibility of governments and industry in Maine and a basic goal of a development plan, must be to take concerted action to maintain this kind of an environment where it exists, to achieve this kind of environment, where it is lacking and to prevent any action that would detract from it.

A quality environment must be an essential partner to Maine’s economic development.