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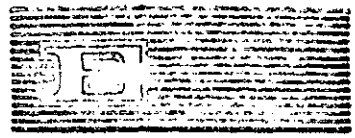

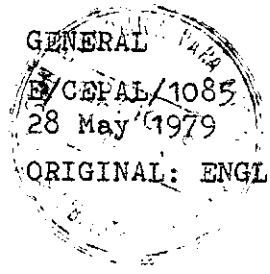


C E P A L

Economic Commission for Latin America

# SURVEY OF HAWAIIAN INTER-ISLAND MARITIME TRANSPORT SYSTEMS IN THE LIGHT OF THEIR SIGNIFICANCE FOR CARIBBEAN INTER-ISLAND TRANSPORT

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## PREFACE

As the Caribbean islands are largely dependent upon extra-regional maritime transport and have very little control over either the speed of technological change in maritime transport or the type of ships which extra-regional operators place in service, there is a risk that an inter-island feeder transport system may emerge which is based on the needs of their extra-regional trading partners rather than on the unique needs of the Caribbean transport environment. To avoid this risk it is necessary to investigate carefully which transport system can carry all inter-island and through-shipment cargoes offered, can operate in all Caribbean island ports, can harmoniously interface with all other transport systems and requires the least capital expenditure. By selecting an inter-island transport system based on criteria such as these, the Caribbean islands will be less dependent upon extra-regional maritime transport decisions and, therefore, less likely to be harmed by changes in transport technology.

## I. INTRODUCTION

Historically, the foreign trade of the Caribbean islands began with the exportation of agricultural products and raw materials to metropolitan centres. As each island had colonial trade commitments with and relied upon the deep-sea transport services of such centres, there was less need for and consequently less development of inter-island transport services. Nonetheless, small amounts of trade were carried between the islands in sailing schooners. With the outbreak of the Second World War the Caribbean islands found themselves not only cut off from traditional markets and the means of transport to such markets but also largely without the means to transport their products to available neighbouring island markets. In response to the need for greater inter-island transport services, action was taken by colonial governments to organize the schooner owner-operators into the wartime Schooner Owners' Association. Under this Association transport services were rationalized, additional

/vessels were

vessels were placed in service, and the volume of inter-island trade grew rapidly. Although after the Second World War the pre-war situation reestablished itself, inter-island trade has shown renewed growth in recent years due to the formation of such regional organizations as CARICOM and ECCM. This growth has placed considerable strain on existing inter-island transport systems.

The trend towards the use of larger and more capital-intensive ships in deep-sea transport restricts the possibility of such ships calling at ports for limited amounts of cargo. As these modern capital-intensive ships are in useful production only when moving goods towards their destination, all time spend in port due to, for example, congestion, weather delays, waiting for cargo and the solution of shore labour problems is non-productive and must be reduced to a minimum. The tendency today is for such ships to call at fewer ports at each end of the voyage. Increasing importance must therefore be placed on feeder transport services - whether by barge, small vessel or truck - not only to supply these ships with cargo but also to deliver cargo to consignees.

As some Caribbean islands are unable to offer sufficient cargo to induce liner operators to make more than occasional calls at their ports, this may, in the absence of government iniatives, lead to a downward spiral of economic activity. Even within the arrangements for CARICOM trade, the lack of an efficient and regular inter-island transport service acts as a disincentive to islanders to expand their production of crops for export. Their earning from exports and their ability to import remain low and in some cases decline. As fewer inward and outward cargoes are offered, fewer calls tend to be made, thereby reinforcing the disincentive. The small amount of cargo which developing island countries have to offer is thus both a cause and effect of the lack of inter-island transport services, and the provision of low-cost, efficient and regular shipping services must hence be viewed as a means by which such island economies may be stimulated

/and so

and so lead to more substantial cargoes being offered in due course. Consequently, inter-island feeder transport services are a most important developmental tool for assisting the growth of island economies.

At a time when the countries of the Caribbean region not only have a shortage of investment capital and transport expertise but also are faced with a rapidly changing transport technology which reduces the number of ports of call by deep-sea transport services, such countries have no alternative but to enlarge inter-island transport servicces. The Caribbean region must have the opportunity to select and inter-island transport system, in this time of change to larger ships calling at fewer ports, rather than being merely a passive victim of the consequences of such change, and it would therefore seem advisable that the Caribbean countries should develop transport solutions for their unique transport environment while ensuring a harmonious interface between Caribbean and extra-regional transport modes.

## II. HAWAIIAN INTER-ISLAND TRANSPORT

Of the many maritime transport decisions currently facing Caribbean nations, two of the most pressing are first, what type of marine transport system is most suitable for the Caribbean inter-island transport environment; and second, once such a system has been selected, what is the most appropriate means for training personnel to operate and manage it? In an effort to provide some general guidelines for determining the most suitable marine transport system for Caribbean inter-island transport, three means of inter-island transport employed in Hawaii were surveyed: (a) the M.V. Hawaiian Princess (HP) - a motorized manned barge; (b) the Barge Islander (BI) - a towed unmanned barge with hull characteristices similar to the HP; and (c) Young Brothers tug and barge service (YB) - towed, unmanned, flat-deck barges 1/.

1/ Flat-deck, manned, self-propelled barges were not included in this survey as they are not employed in Hawaiian inter-island trade.

/At the

At the outset it should be understood that both the HP and BI are owned by Matson Navigation Company while YB is a wholly owned subsidiary of the Dillingham Maritime Corporation. Although both Matson and YB transport goods in inter-Hawaiian island trade, Matson is an inter-state carrier while YB is an intra-state carrier.

The 3,875 grt HP was constructed in 1967 at Bethlehem Shipyard, Beaumont, Texas, and has an overall length of 338'3", a breadth of 52', and a loaded draft of 18'. It is a manned vessel which carries 212 Matson standard twenty-four foot containers - half of which are carried below deck in 3 cargo holds - and 6,946 barrels of molasses. Additionally, 20 of the 212 containers may be refrigerated. For container handling operations the HP has a vertical lift-on/lift-off (LO/LO) gantry crane, and as it is fitted with twin screws and a bow thruster, the need for tug docking services has been eliminated. Although the U.S. Coast Guard rates the HP for a crew of 13, it carries a crew of 20 due to union requirements (see annex 1).

The HP was originally constructed to carry only one tier of containers on deck, but due to growth in demand for more container space the gantry crane was raised to permit two additional tiers of containers on deck. This increased deck load of containers has reduced the independent character of its original construction by making shore-side crane services necessary for the third or highest level of deck-carried containers. Additionally, the HP uses shore-side straddle-carriers to move containers from shipside to dock storage areas.

All cargo carried on the HP, with the exception of molasses, is containerized. However, the trade is unbalanced and depending on the island from which the backhaul originates, only 10% to 50% of the containers transported from outer islands to the main island of Oahu carry cargo.

The 3,403 grt BI was constructed in 1963 at Bethlehem Shipyard, Beaumont, Texas, and has an overall length of 312', a breadth of 50', and a loaded draft of 17'10". It is an unmanned towed

/barge which

barge which carries 216 Matson standard twenty-four foot containers - 101 of them carried below deck in 3 cargo holds. Additionally, 19 of the 216 containers may be refrigerated. For container handling operatios the BI has a drag crawler vertical LO/LO crane (see annex 2). As this crane has its own diesel engine, it operates independently of barge and shore-side power systems. For refrigerated containers the BI has two diesel generators of 350 kw each. These diesel generators are so installed that the engine on stand-by will come on-line automatically if the other stops for any reason. The BI averages 9 knots with a tug boat of approximately 2,700 horsepower.

The BI was employed from 1963 to 1967 in Hawaiian inter-island trade. During this period risks were encountered which are somewhat inherent in tug and barge docking operations. For example, in docking a barge the towing tug will shorten its tow-line, make a "U" turn and go alongside the barge to push it against the dock. As this "jack-knife" operation requires a high degree of seamanship, knowledge of the drift characteristics of barges in different tide conditions, and familiarity with the amount of power necessary to push the barge against a dock without risk of hull damage, Matson found that such operations were costing about US$ 4,000.00 per month in hull damage to the BI. However, the majority of these hull repairs were due to strict U.S. Coast Guard requirements and not to any lack of seaworthiness of the BI, and once Matson engaged another tug company hull damage to the BI from such docking procedures was eliminated.

The BI is currently employed on a 28-day deep-sea towage cycle between Hawaii and two - Majaro and Kwajalien - of the Marshall Islands. The BI was constructed for all-container transport, but as the BI provides the only cargo transport service to these islands some construction steel is accommodated in deck spaces normally reserved for containers. The trade, however, is unbalanced - only about 10% of the containers transported from the Marshall Islands to Hawaii have cargo.

Young Brothers operate an inter-island tug and barge service between five Hawaiian islands approximately three times per week. This frequency of service requires 4 tugs and 8 barges. The tugs employed in inter-island service are from 1,600 to 3,334 horsepower and tow at approximately 9 knots. As these tugs have crews of 8, which does not permit on-board maintenance, YB has a shoreside engine shop for all planned maintenance and repairs. The barges employed range from 2,000 to 5,500 dwt and, with the exceptions of the tank and grain barges, transport a wide range of conventional, palletized, refrigerated and containerized cargoes. These flat-deck barges utilize the horizontal roll-on/roll-off (RO/RO) mode. However, trailers or chassis are not used for this RO/RO mode as YB employs fork-lifts and ramps it has placed on each island for loading and unloading operations, as well as for movement to and from dock-side storage areas (see annex 3). It is interesting to note that the Report of the Group of Experts on Feeder and Inter-island Services by Air or Sea for Island Developing Countries (TD/B/AC.24/1) stated in paragraph 44 that:

> "We consider that the type of vessel which offers greatest cargo-handling flexibility is that which is designed for horizontal handling, although such handling methods are only possible at points where a vessel can either berth or beach" (underlined in the original).

To reduce the risk of breaking a tow-line, and to enhance the possibilities of recovery should a tow-line break, YB do not tow barges in series on a single tow-line, but instead tow two barges using separate towing winches and tow-lines on the same tug boat (see annex 4).

The trade flow for YB is unbalanced, since the barges normally return to Oahu only 20% loaded. As approximately 40% of the containers carried by YB are refrigerated, the barges have diesel generators, but as transport distnaces between islands are 145 miles or less, installation of twin diesel generator units -one unit on-line and the other on stand-by in case of emergency - was considered unnecessary.

/Young Brothers

Young Brothers employ the "drop and switch" method of barge transport - delivery of a barge and picking up of another - thereby permitting the tug to be fully utilized in the transport of cargo. Moreover, this method of transport permits barges to be loaded and unloaded on a more regular basis.

SUMMARY OF CARGO UNITS PRESENTLY TRANSPORTED BY EACH HAWAIIAN INTER-ISLAND OPERATION SURVEYED AND PORT FACILITIES UTILIZED

| | HP | BI | YB |
|---|---|---|---|
| Cargo units transported | | | |
| Conventional | | | x |
| Palletized | | | x |
| Refrigerated containers | x | x | x |
| Containers | x | x | x |
| Bulk-dry | | | x |
| Bulk-molasses | x | | |
| Bulk-petroleum | | | x |
| Live animals | | | x |
| Indivisible odd sized units | | x | x |
| Bales | | | x |
| Port facilities utilized | | | |
| Straddle-carriers | x | x | |
| Shore-side crane services | x | x | |
| Fork-lifts | | | x |
| Ramp from dock to barge | | | x |

Although the HP and BI were constructed to carry only containers, it should be understood that such containers may contain almost anything able to be fitted into a Matson standard twenty-four foot container - including pallets, bales, conventional and bulk cargoes. Further, while the HP and BI are capable of transporting pallets in spaces normally reserved for containers or utilizing fork lifts instead of straddle carriers to move containers to and from the ship's side, these possibilities are not shown in the above table because it only presents actual cargo units transported and port facilities utilized by each inter-island transport operation surveyed.

/While the

While the HP and BI are limited to the Matson container, YB have much more flexible cargo grouping requirements. For example, YB have partially-enclosed barges in which bales, conventional and palletized cargoes may be transported without exposure to the weather, and they also have special cargo grouping units of varying sizes for the transport of live animals and dry cargoes. Thus, as can be seen from the table, YB carry a much wider variety of transport units and hence cargoes, since they are neither dependent upon nor limited by standard container units, although they can easily transport them.

## III. CARIBBEAN INTER-ISLAND TRANSPORT

While there are many aspects of Caribbean inter-island transport that should be given careful study when selecting an inter-island feeder transport system, some of the more important for this discussion are: (a) what cargoes and volumes of such cargoes are to be transported; (b) what are the normal shipping units - bulk minerals, agricultural products, refrigerated and non-refrigerated containers, indivisible odd-sized units, etc. - of the cargoes to be transported; (c) what port facilities are available; and (d) what is the present and projected relationship between extra-regional and inter-island transport services?

The trade structure of the Caribbean may be characterized in general terms by dependence on a limited range of agricultural and mineral primary exports and by the need to import most capital and consumer goods. While each of these groups of products - agricultural, mineral and manufactured - may be transported by specialized vessels, the limited volumes involved and the seasonal changes in the tonnages of such cargoes discourage capital investments in specialized vessels and related port facilities. Further, as each of these groups of products is normally presented in different shipping units - conventional, palletized, refrigerated, containerized, bulk-dry and liquid, bales, live animals and indivisible

/odd-sized

odd-sized units - an inter-island transport system must be sufficiently flexible to transport all of them.

An important influence on the development of port systems has been the construction of specialized ships, including those for the transport of unitized cargoes. While the principal Caribbean islands have responded to this trend by constructing deep water ports with container facilities, some outer Caribbean islands have, as yet, only shallow water berths with little or no cargo handling equipment. As an inter-island transport system for the Caribbean should have sufficient operational flexibility to provide regular transport services to all islands, such a system should be as independent as possible of shore-side cargo handling equipment and capable of operating in shallow draft harbours. With reference to the need for such flexibility, the Report of the Group of Experts on Feeder and Inter-island Services by Air or Sea for Island Developing Countries (TD/B/AC.24/1) noted in paragraph 42:

> "Types of vessels: ... the need for flexibility in operations must be stressed. This need arises from the fact that the low volumes necessitate calls at numerous ports, each of which may have different facilities, and some of which may lack facilities almost entirely. Flexibility is also needed to cater for changes in the tonnages and types of cargoes moving."

Although the modern containerized transport system was designed to link one capital-intensive economy with another, developing island countries of the Caribbean region have, for a variety of reasons, begun to use containers for maritime transport. While the primary task of an inter-island transport system is to give minor ports access to world trade via trans-shipment at intermediate ports, the combination of sophisticated deep-sea container tonnage and inter-island transport services often requires changes in transport technology between the two systems. As was noted in paragraph 38 of the above-mentioned Report:

> "In this situation focal, or trans-shipment, centres serve a dual role. These points serve not only to disperse or accumulate main-line cargoes (as in the case of conventional trans-shipment operations) but also as a means of changing from one technology employed to another, so that different technologies can be employed between focal points and outer islands."

/As a

As a modern deep-sea container ship may unload containers at an intermediate port for trans-shipment to an outer island, the unimpeded through movement of goods from points of origin to ultimate consignees requires a harmonious interface between and co-ordination of inter-island and liner transport networks.

## IV. TUG AND BARGE TRANSPORT

As barges may be loaded and unloaded at any shallow draft or break-bulk berth, the port requirements for tug and barge systems are extremely small. In some cases a dock may not even be required, as cargo may be transferred to and from the shore by barges capable of being beached. Such solutions are usually sought in areas where there is insufficient traffic to make investments in physical port facilities viable, or in cases where it might be technically difficult or impossible to construct such installations. For example, equipment for the Distant Early Warning radar system was transported by Dillingham Maritime Corporation in barges designed for beaching in remote areas - from the Gulf of Alaska to the Aleutian Islands - where there were no port facilities. These same techniques were also used in the transport of oil drilling rigs and other exploratory equipment to remote areas of Alaska.

While modern liner vessels require specialized capital-intensive cargo handling facilities, whether on the vessel or shore-side, barges in inter-island service generally transport a wide range of low volume cargoes and therefore require cargo handling facilities which are largely labour-intensive. As the tug and barge system does not commit outer Caribbean island developing countries to expensive port facilities nor does it disrupt traditional labour practices which they may think are socially desirable, the introduction of this system could not only provide such countries with a broad basis for participation in the transport of their goods but also assist in making exports as competitive as possible on world markets and imports as cheap as possible for local buyers.

/The adoption

The adoption of the tug and barge transport system in no way excludes other transport systems. For example, a modern liner may unload containers at an intermediate port by means of sophisticated shore-side gantry cranes while an inter-island tug and barge service may load and unload these same containers by means of a ramp from the dock to the barge and a fork-lift. Further, barges can transport not only containers but also a whole range of goods which cannot be readily accommodated in containers. The tug and barge system, therefore, eliminates a main problem of cellular container ships - the residual cargo.

As the trend is towards rising transport costs, increasing costs for port development, and hence a need for greater berth throughput to pay for such port development, the tug and barge system offers considerable advantages over other transport arrangements, the main positive features of this system being as follows:

(1) Tugs are readily interchangable. If for any reason one tug is out of service another can be used in its place.

(2) A tug with a given barge cargo capacity requires a smaller crew than does a ship of similar cargo characteristics and therefore reduces crew costs.

(3) Tugs are generally standardized off-the-shelf items.

(4) Tugs are more maneuverable than most manned vessels and do not, of course, require docking tugs.

(5) Tugs have multiple uses - towing, docking, acting as pilot and fire boats, and general salvage work.

(6) As tugs can be standardized, training for crews can be simplified and crew interchange facilitated.

(7) A shore-side facility for tug engine maintenance provides a greater degree of quality control over such maintenance, ensures that the maintenance is actually performed, and gives a chance for other necessary repair work to be simultaneously undertaken.

(8) Barges readily permit the transport of goods which require special or lengthy handling operations.

/(9) Barges

(9) Barges can easily be constructed or modified to meet the requirements of the goods to be transported or to conform to the requirements of ports in which they will operate.

(10) Barges require a relatively small financial outlay and can be constructed by small shipyards - including those of developing countries.

(11) Barges have multiple uses - transport and storage of cargo, and almost any use requiring a stable floating platform.

(12) Barges can be designed for beaching in areas where there are no port facilities.

(13) Tugs towing barges are more fuel efficient than self-propelled vessels of similar cargo characteristics because of their lower system speed.

(14) Cargo handling operations can be more suitably organized to avoid payment of overtime charges for stevedores and equipment, since the cost of barge time is a less significant cost factor than that of a manned vessel.

The major disadvantages of the tug and barge transport system are as follows:

(1) Marine insurance rates for tugs and barges are higher than for manned vessels due to the risks of breaking a tow-line and hull damage during "jack-knife" docking procedures.

(2) Tugs have generally 10 days per year less operating time than manned vessels due to the down time for engine maintenance.

(3) A tug towing barges will be slower than a manned vessel of similar transport capacity, due to the additional resistance of the tow line and the barge's fixed rudder.

## V. CONCLUSION

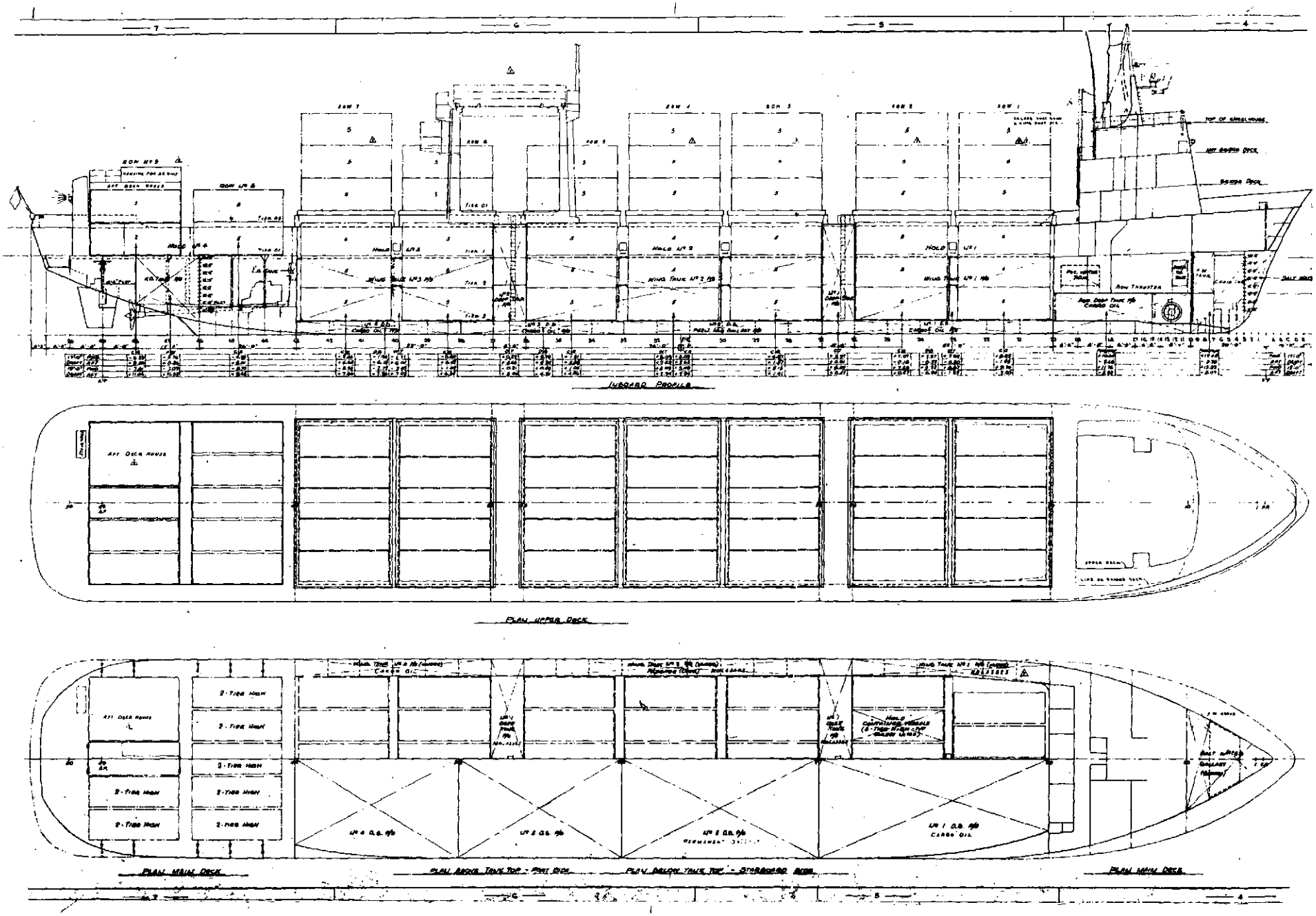
Correct decisions with respect to the types of inter-island transport systems to be employed in the Caribbean region are of major importance because they can not only assure the Caribbean region a fair share in the transport of its world trade but also actively contribute to formal integration schemes.

/Since the

Since the speed of technological change in marine transport renders it impossible to predict an assured future for any transport system, there are strong grounds for recommending only systems with inherent operational flexibility. As the tug and barge transport system appears to offer broad adaptability to a wide range of shippers' needs and ports with differing facilities and water depths, it would seem advisable that careful study be given to the economic and technical feasibility of its application to Caribbean inter-island transport.

/Annex 1

ANNEX 1




The M. V. Hawaiian Princess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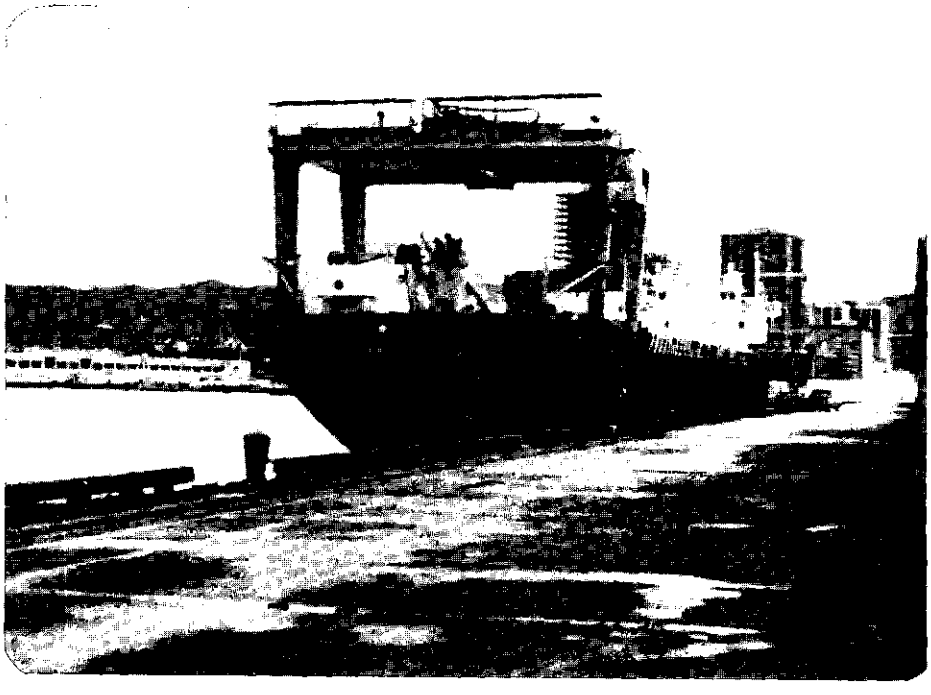
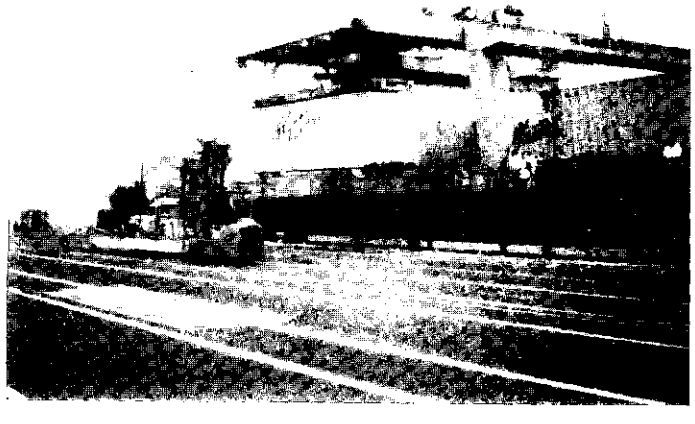
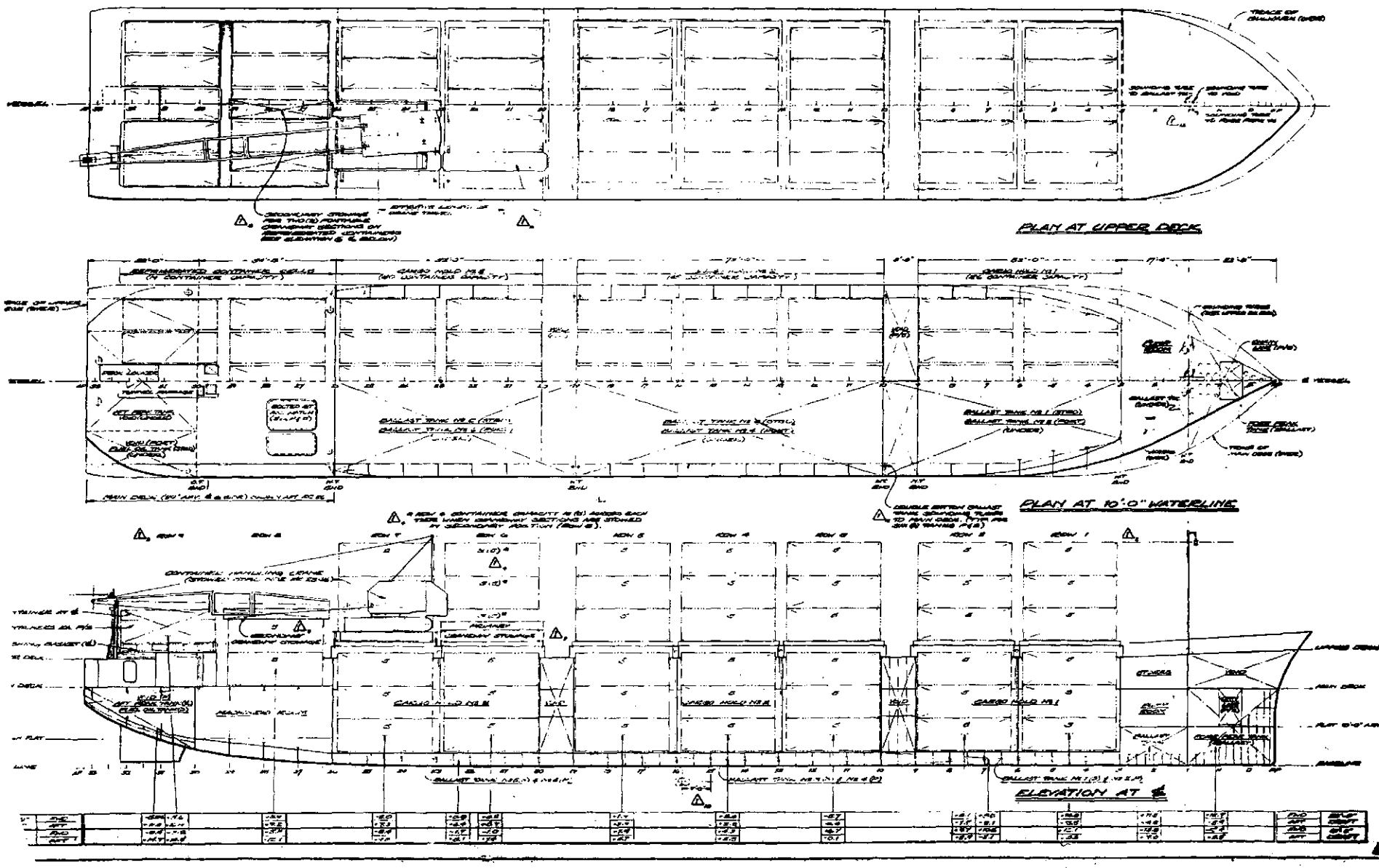


The M. V. Hawaiian Princess



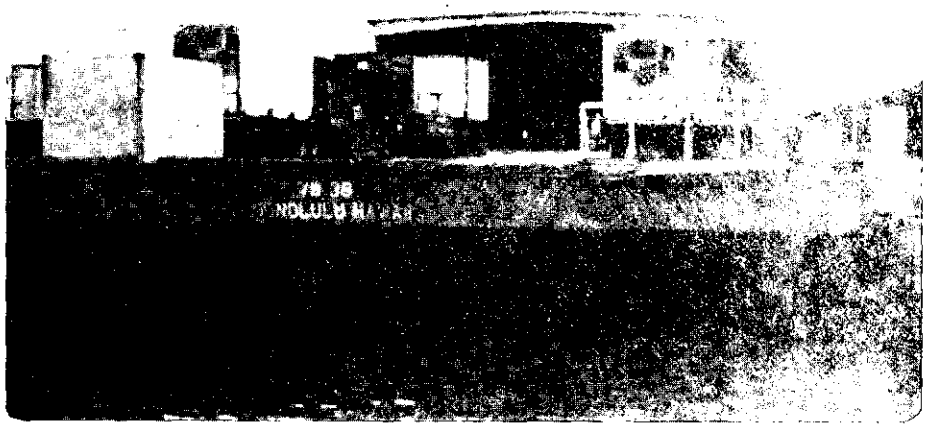
Gantry crane of the M.V. Hawaiian Princess discharging containers

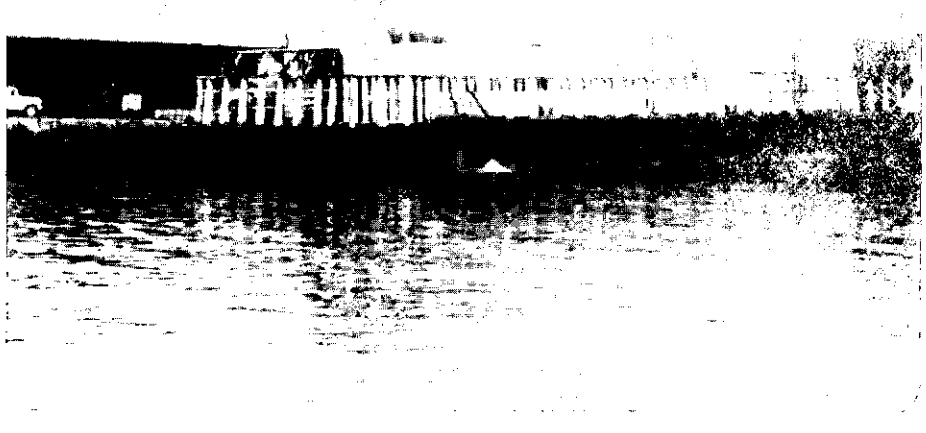
ANNEX 2



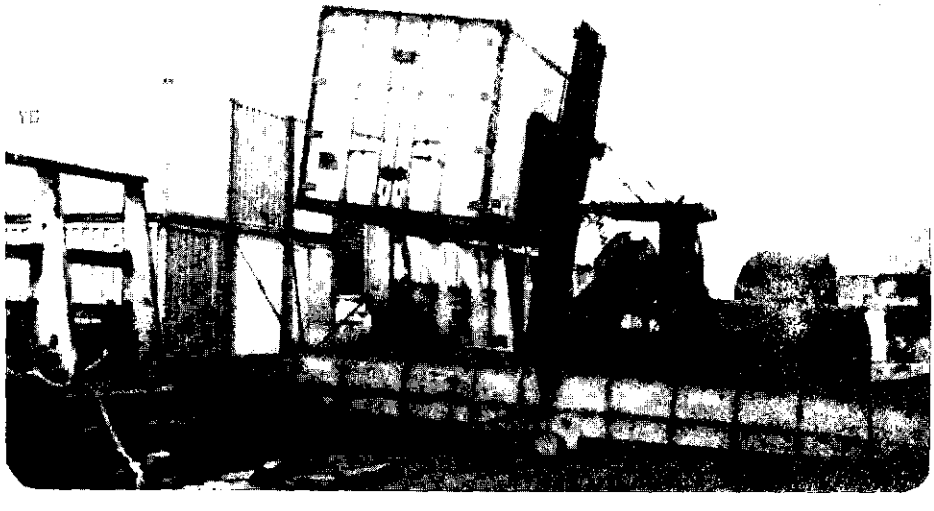

The Barge Islander

ANNEX 3

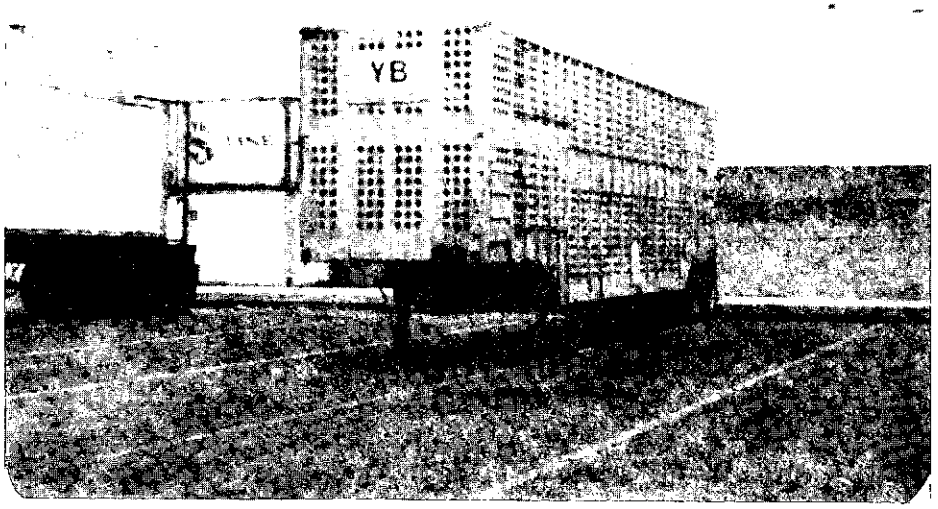




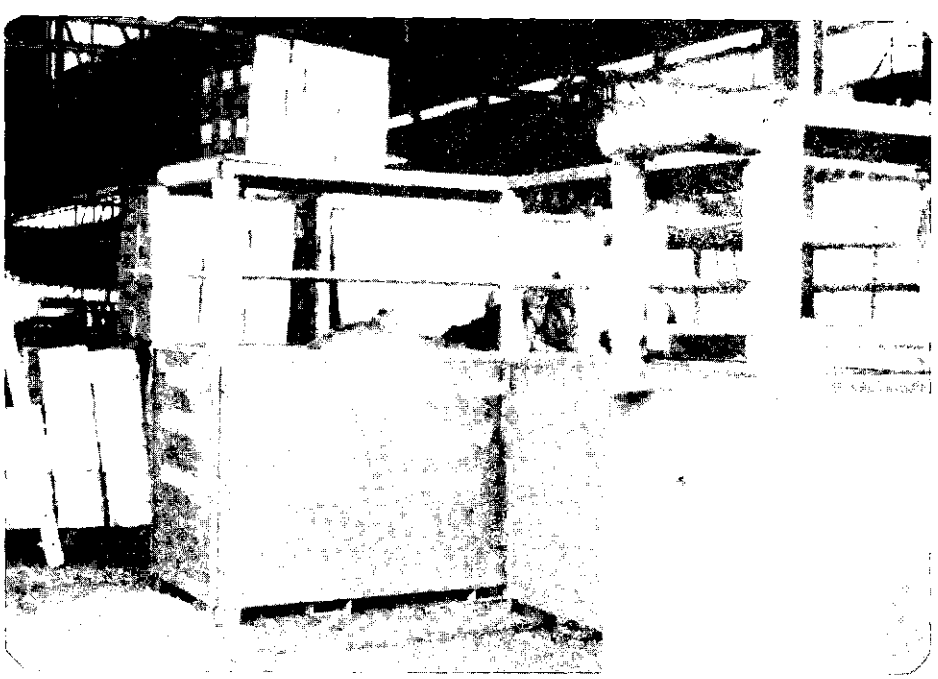
Young Brothers flatdeck barges



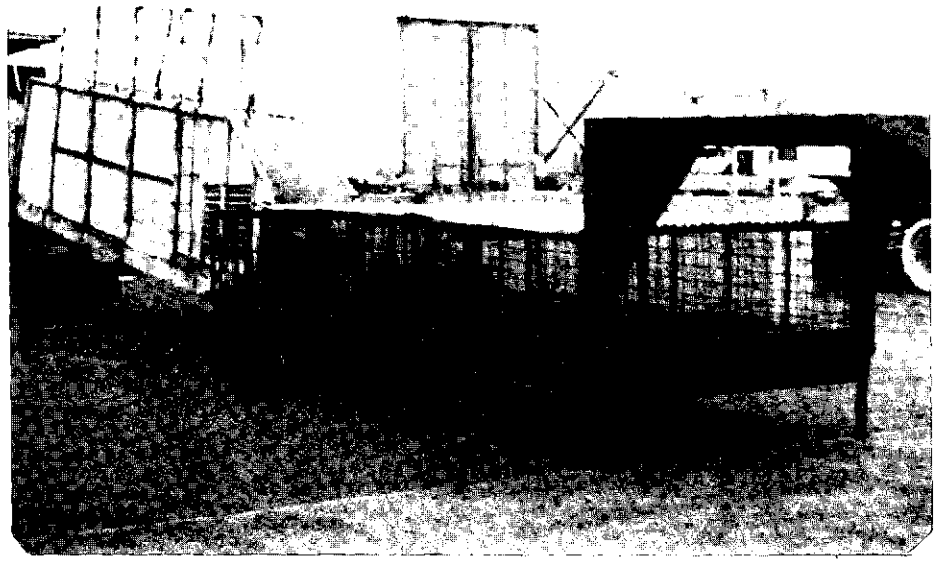
Horizontal roll-on/roll-off (RO/RO)




Container for cattle



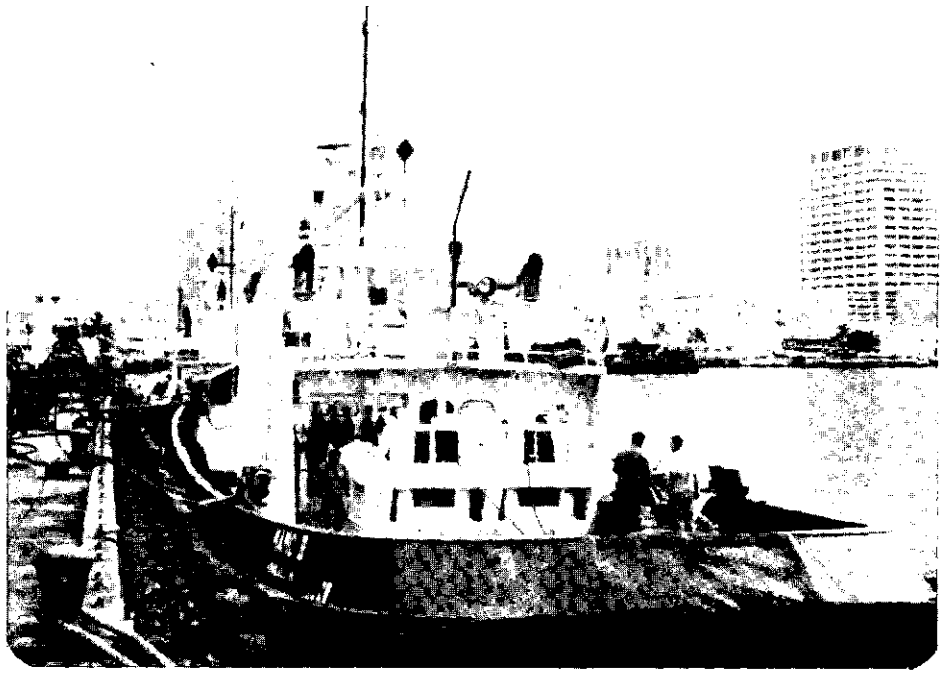
Containers for horses



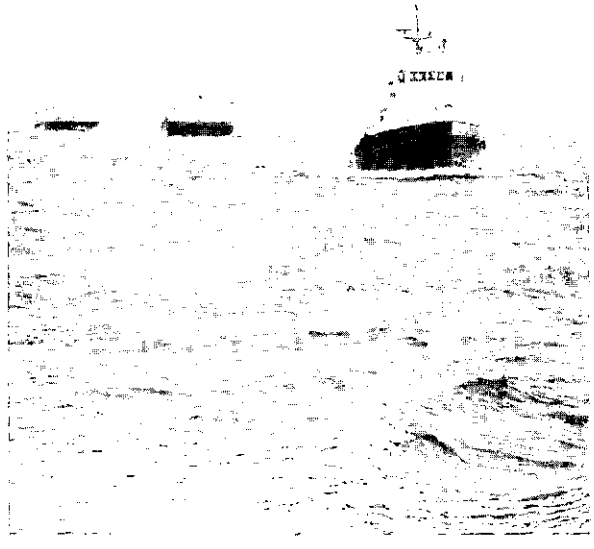
Container for pigs

Cargo accumulation unit in dock warehouse for small quantity shippers of refrigerated goods

ANNEX 4



Young Brothers tug with two towing winches



Double tow by Young Brother using two towing winches