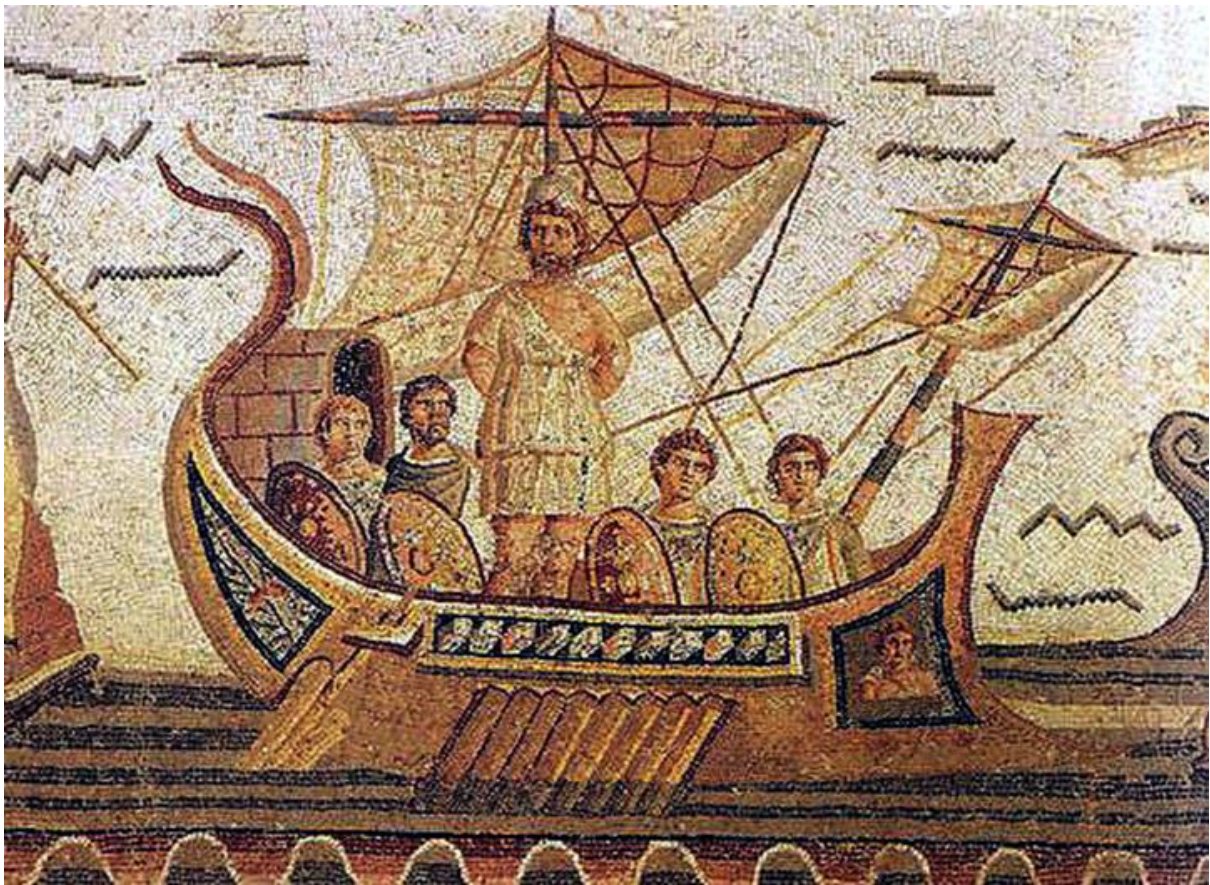




AN ECONOMIC MODEL OF A SHORT SEA SHIPPING SERVICE IN THE SOUTHERN CARIBBEAN

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Purpose of the Presentation

The purpose of the presentation is to present an economic model of short sea shipping in the southern Caribbean based on proposals made for such a service. As a matter of context, at present, the governments of the CARICOM (Caribbean Community) are currently considering the creation of an intra-regional cargo and passenger/ driver (ROPAX) ferry service in the Southern Caribbean. The stated objective of the regional governments is to support food security in the region having regard to global disruptions in international trade. The proposal is still in its formative stages.

Shipping Service Area Defined

The shipping market model presented in this study area is designed to provide short sea shipping connectivity between Georgetown, Guyana; Port of Spain, Trinidad and Bridgetown, Barbados in a **weekly service loop** (round trip).

Short Sea Shipping: A definition

Short Sea **Shipping**, abbreviated as **SSS**, is the maritime transport of goods over relatively short distances, as opposed to the intercontinental cross-ocean [deep sea shipping](#). This definition is derived from Commission Communication [COM \(1999\) 317 final](#) of June 1999 on the development of SSS in Europe (page 2) (Eurostat, ISSN 2443-8219).

As a result, short sea shipping also includes **feeder services**: a short-sea network between ports with the objective of consolidating or redistributing freight to or from a [deep sea service](#) in one of these ports, the so-called [hub port](#) (Eurostat, ISSN 2443-8219).

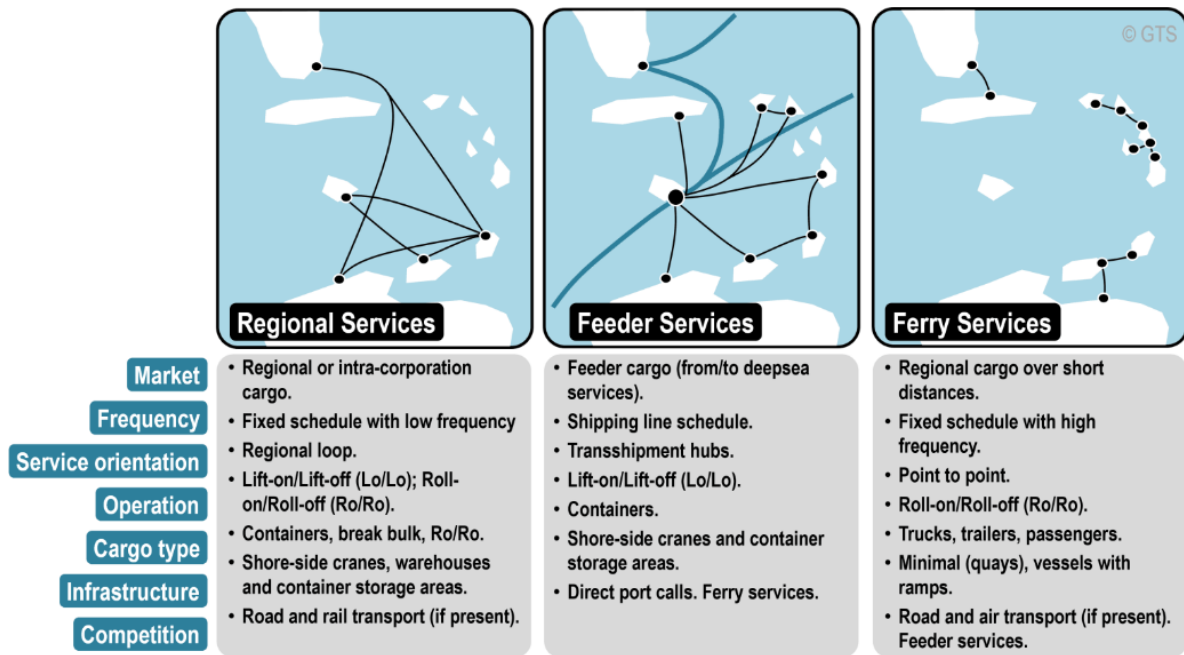
Short sea cargoes include grain, fertilizer, coal, lumber, steel, clay, aggregates, containers, wheeled vehicles, and passengers. Short sea shipping is also subject to many political restrictions. The most important is cabotage, the practice by which countries enact laws reserving coastal trade to ships of their national fleet. This system has mainly been operated in countries with very long coastlines, such as the United States and Brazil, but is no longer as prevalent as it used to be (Maritime Economics, Martin Stopford, 2009).

For the purpose of with the International Maritime Organization Convention on the Safety of Life at Sea (SOLAS), a voyage undertaken by a vessel engaged in short sea shipping in the Southern Caribbean region would be classified as a short international voyage based on the following definition:

“(a) Short international voyage” means an international voyage in the course of which a ship is not more than 200 miles from a port or place in which the passengers and crew could be placed in safety, and which does not exceed 600 miles in length between the last port of call in the country in which the voyage begins and the final port of destination” (IMO SOLAS Convention, 1974, chapter 2, Regulation 2- Definitions)

Characteristics of Short Sea Shipping

It is also important to make a distinction between the terminology **Short Sea Shipping** and a **Regional ferry service**. Jean Paul Rodrigue in his text, ‘The Geography of Transport Systems (5th edition, 2020) characterizes short sea shipping as a single type of shipping service, which involves three (3) distinct modalities of service, as follows:



Characteristics of Short Sea Shipping Services

Figure 1: Characteristics of Short Sea Shipping

Source: Jean-Paul Rodrigue, *The Geography of Transport Systems*, 5th edition (2020).

- **Regional Short Sea Services.** Concerns specific connections that are designed to service commercial relations, commonly within the same corporation (dedicated single services) with scheduled but low-frequency services. Depending on the commercial relation, it can involve bulk or containerized cargoes carried by smaller ships, unless large volumes of bulk cargoes are involved, such as for petroleum or mining products.
- **Feeder Services.** Connections are integrated into the global container shipping network through [transshipment hubs](#) to move containers from feeder (smaller ships) to deepsea (large ships) services. These services are scheduled according to the network strategies of the shipping lines and can be replaced with direct calls if volumes are substantial enough. Feeder services effectively link smaller ports to the global shipping network. Still, they involve additional delays due to transshipment and higher costs per TEU because of the lack of economies of scale.
- **Ferry Services.** Fixed point-to-point services running on scheduled and high-frequency routes that usually accommodate a combination of passengers and freight flows using roll-on / roll-off operations. They are present to service well-defined connections that include social (passengers) and commercial (freight) interactions.

Martin Stopford in his text, 'Maritime Economics' (3rd edition, 2009) defines a **liner shipping service**, as follows:

A liner service is a fleet of ships, with a common ownership or management, which provide a fixed service, at regular intervals, between named ports, and offer transport to any goods in the catchment area served by those ports and ready for transit by their sailing dates. A fixed itinerary, inclusion in a regular service, and the obligation to accept cargo from all comers and to sail, whether filled or not, on the date fixed by a published schedule are what distinguish the liner from the tramp service.

Another important feature of a ro-ro liner shipping service is that the ship provides its own fleet of container handling equipment i.e. trucks (cabs) and container trailers and container units (TEUs and FEUs), which may be either owned or leased equipment.

On the other hand, a Regional Ferry Service generally typically relies on the passengers to provide their own mode of transportation for carriage of goods by sea whether it is an industrial container truck and chassis, a commercial truck or van, a light goods vehicle or a personal vehicle.

These are important distinctions to be made because they have implications for the type of service offered, the operating cost of the service and the level of market competition in an industry which was previously characterized as a good example of perfect competition but has over the years evolved into a market of concentration and consolidation through mergers and acquisitions and global and regional shipping alliances.

Research Questions

The webinar will address some of the major issues to be considered when establishing a regional ferry service in the southern Caribbean and consider such questions as follows:

- **Regional Food Security:** Is regional food security a matter for some Caribbean countries, the southern Caribbean intra-region or the Caribbean region as a whole and what mechanisms exist to support food security in the region?
- **Geography of Intra-Regional Transport:** What is the study area to be defined when considering maritime trade and transportation and is the OECS area to be included in the proposed Guyana, Trinidad and Tobago and Barbados shipping service?
- **Trade and Industry:** What is the value, volume and type of intra-regional sea-borne trade within the southern Caribbean region?
- **Demand Analysis:** What is the level of demand for marine transportation services and how can it be categorized, classified and assessed for the movement of passengers and cargo vehicles and the modality of shipping logistics required?
- **Existing Shipping Services:** What regional (Miami feeders) and Intra-regional (schooner ships) services exist and how well served is the southern Caribbean by existing services and are there critical gaps in the system?
- **Supply Analysis:** Is there a proven demand for a regional ferry service and, if so, what are the ship design and technical specifications required, the optimal route rotation, service frequency and number of vessels required to operate such a service?
- **Environmental Analysis:** What are the critical environmental issues to be considered by regional governments in relation to the achievement of the United Nations Sustainable Development Goals 2030 and 2050, respectively?
- **Infrastructure Investment:** What is the level of investment in infrastructure and facilities required in order to accommodate and support intra-regional trade and transportation?
- **Business Process Re-engineering:** is there a need to re-engineer existing business processes by state agencies and the private sector in order to facilitate intra- regional trade, shipping and transportation logistics?
- **Regional Shipping Service:** Is there a need for a CARICOM sponsored regional ferry service initiative and if so, what public/ private business model should be pursued in order to ensure a successful pilot project and financial sustainability within a competitive market place?

Value of Trade

Table 1: CIF Value of Trade between Trinidad and Tobago and Guyana

Year	Exports	Imports	Ratio Exp to Imp
2018	3020591773	232786223	13
2019	1763084923	207207508	9
2020	749886233	212528823	4
2021	1119479469	235039223	5
2022	1419895542	263966545	5
2023	1520390846	254030545	6

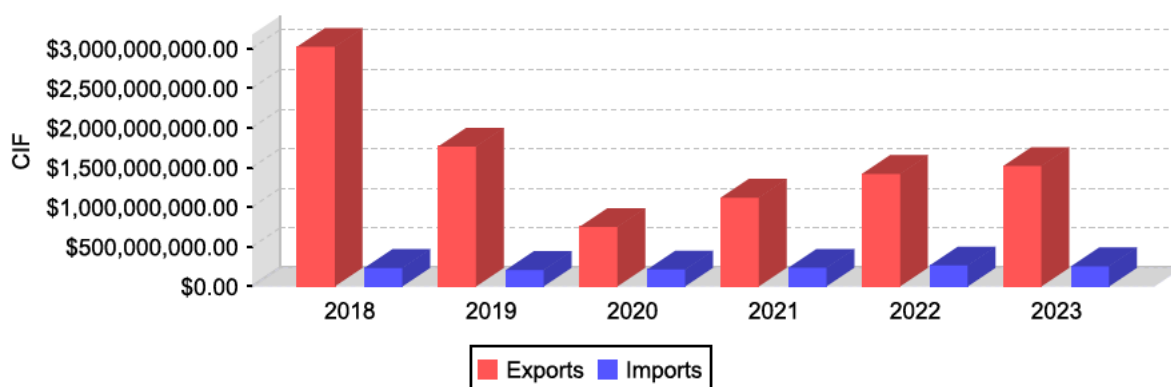
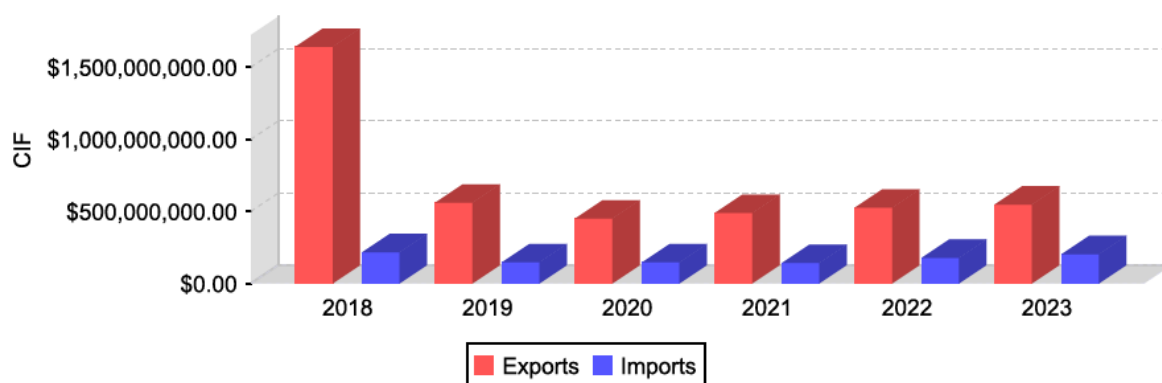


Table 2: CIF Value of Trade between Trinidad and Tobago and Barbados

Year	Exports	Imports	Ratio Exp to Imp
2018	1641296339	217364348	8
2019	560915811	147836854	4
2020	450433788	146322163	3
2021	489364660	141803443	3
2022	525618135	178028403	3
2023	547644340	203203098	3



Merchandise Trade

A detailed spreadsheet provided by the Ministry of Finance listing the type of merchandise trade between Trinidad and Tobago and Barbados and Guyana, respectively, shows a range of goods across all categories comprising mainly manufactured, commercial, wholesale and retail distribution goods, all of which may be containerized into FCL or LCL shipments.

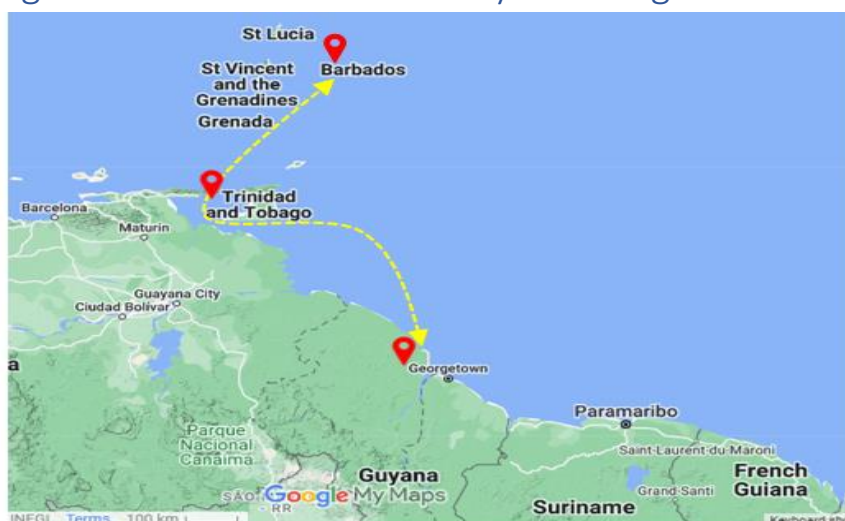
Estimate of Annual Cargo and Container Throughput

Table 3: Estimate of Annual Cargo Tonnage/ Container TEU Trade

From Country A (1)	To Country B (2)	Cargo Tonnage (MT) Throughput (3)	Container (TEU) Throughput (4)	Add Seasonal Peaking Factor 1.3 (5)	Weekly TEU Throughput (6)
Guyana	Trinidad	48,000	4,000	5,200	100
Trinidad	Barbados	72,000	6,000	7,800	150
Barbados	Trinidad	36,000	3,000	3,900	75
Barbados	Guyana	36,000	3,000	3,900	75
Trinidad	Guyana	72,000	6,000	7,800	150
All Countries	All Countries	240,000	22,000	28,600	550

Footnote 1: Assume 12 tonnes per TEU (column 4).

Map showing route rotation for a weekly intra-regional service



Source: https://www.google.com/maps/d/viewer?mid=1U4YGIEe_bsKN7j-mNGR2LmTLzkk&hl=en_US&ll=10.043295626949464%2C59.678607078409954&z=6

Figure 2: Map of the Study Area

Vessel Specifications

The vessel particulars presented in this research study are taken from the Bridgemans Marine Transport Brochure: MV Cabo Star. The vessel is a ro-ro cargo ferry with 2500 lane metres and capacity for 130 passengers. It has a capacity of 12 sleeper cabins and 30 crew cabins. Passenger common user area facilities include seating lounges with big screen television, food and beverage cafeteria with dining area, public rest rooms and fitness facility.

The main particulars are as follows:

MAIN PARTICULARS

TYPE	320-Roll on/ Roll off Carrier
FLAG	Panama
PORT OF REGISTRY	Panama
IMO	8500680
BUILT	1988, Stocznia Gdansk Shipyard, Poland
CLASS NOTATION	1A1 General cargo carrier Ro/RO E0 ICE (1A*)

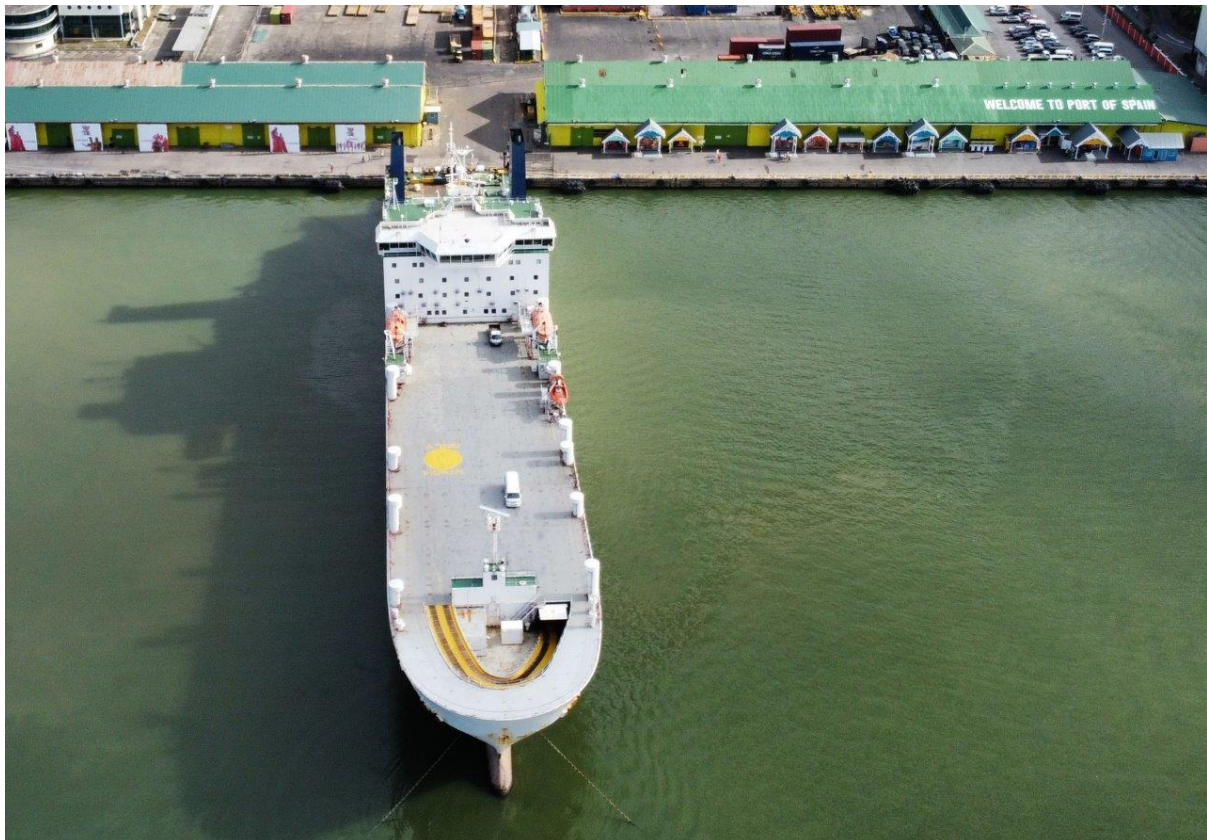


Figure 3: MV Cabo Star Mediterranean Berthing

The technical specifications for the Machinery are as follows:

MACHINERY

Propelling Type:	2 x CPP-s type LIAAN EF 147/410
Gearboxes:	2 x Single stage Lohman Stolterfoht type GUH 1161
Main Engines:	2 x 4 stroke Sulzer 12V ZAV40S
Total Output:	at 510 RPM 14400 kW
Auxiliary Engines :	2 x Wärtsilä 8R22RF each 1380 kVA at 1000 rpm 1 x Wärtsilä 6R22RF 1040 kVA at 1000 rpm
Emergency Generator:	MAN 6D28 154 kVA at 1500 rpm
Bow Thruster:	KameWa 4 blade CPP 1200 kW

PERFORMANCE:

19 KN at 80% 44m³ HFO & 3.8m³ MGO
18 KN at 70% 38 m³ HFO & 3.8 m³ MGO
17 KN at 62% 36 m³ HFO & 3.8 m³ MGO



Figure 4: MV Cabo Star showing Stern Ramp Loading Deck

The technical specifications of the vessel are as follows:

DIMENSIONS

Gross Tonnage:	19963 T
Net Tonnage:	5989 T
Lightweight:	9114 T
Deadweight:	8842 T
Overall Length:	157.6 m
LPP:	145 m
Breadth:	25.3 m
Depth:	13.9 m / 7.95m
Max Draft:	7.294 m



Figure 5: MV Cabo Star showing Loaded Weather Deck

The cargo handling specifications are as follows:

CARGO HANDLING SYSTEM

STERN CARGO RAMP	(B x H) 15.5 m X 11.0 m
Deck 1	Access height 4.2 m Total 1117 m ³ or Total 320 m @ 4.7 m
Deck 2	Access height 5.68 m Total 2269 m ³ or Total 800 m @ 4.7 m
Deck 3	Access height 5.68 m Total 2784 m ³ or Total 970 m @ 4.7 m
Deck 4	Access height 2.75 m via ramp Total 1248 m ³ (144 TEU) or Total 530 linemetres @ 2 m

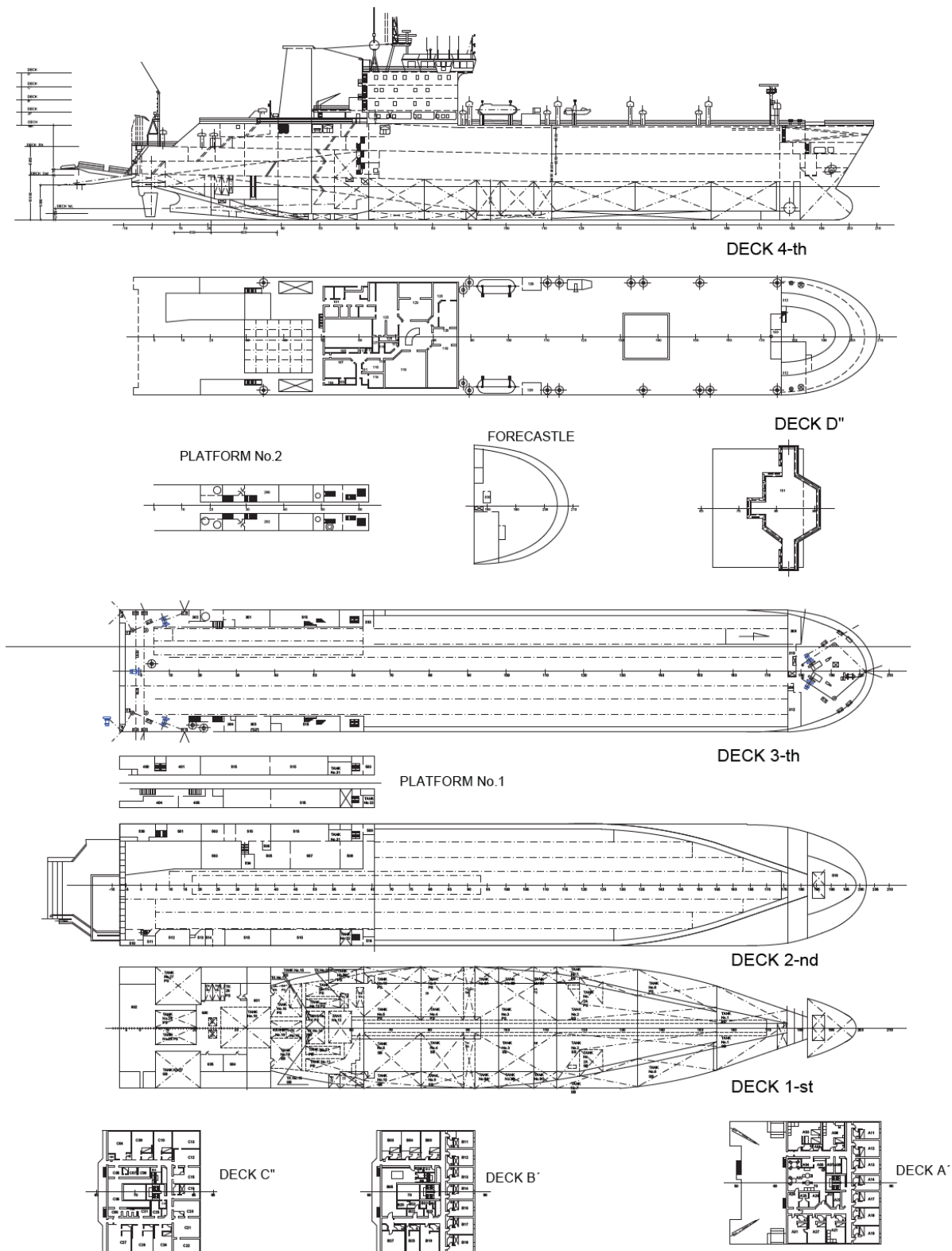


Figure 6: MV Cabo Star Vessel Schematics

Proposed Weekly Route Rotation

Table 4: Table showing Nautical Distances and Transit Times

Route	Distance in miles	Distance in nautical miles	Transit Time @14.5 knots	Transit Time @13.5 knots
Guyana =>Trinidad	459	399	28	31
Trinidad => Barbados	289	251	28	31
Barbados => Trinidad	289	251	28	31
Trinidad => Guyana	459	399	28	31
Total Nautical Distance and Transit Time		1300	112	124
Vessel Turnaround Time in Port	12 hours x 5 port calls		60	60
Estimated Round-Trip Hours			172	184
Estimated Round-Trip Days			7	7.6

Source: <http://ports.com/sea-route/port-of-georgetown,guyana/port-of-port-of-spain,trinidad-and-tobago/#/?a=0&b=0&c=Port%20of%20Georgetown.%20Guyana&d=Port%20of%20Port%20of%20Spain.%20Trinidad%20and%20Tobago>
<http://ports.com/sea-route/port-of-port-of-spain,trinidad-and-tobago/port-of-bridgetown,barbados/>

Model Assumptions

The shipping model is based on the use of MV Cabo Star as follows:

- **Cargo Transport demand:** An estimate of the demand for containerized shipping and ro-ro container handling services.
- **Route Rotation:** The service proposed will run from Guyana to Trinidad to Barbados in a weekly service loop (round trip). See figure 2: Map of the Study Area as described earlier.
- **Cargo handling time in port:** The estimated cargo handling time spent in port is 8 hours.
- **Vessel total turnaround time:** The estimated vessel turnaround time in port is 12 hours.
- **Service Speed:** The service speed in the fuel consumption calculations is based on 13.5 knots.

Annual Operating Costs

Time Charter costs

- **Daily Time charter rate:** US\$20,000 based on current market conditions
- **Drydock off-hire days:** Two (2) weeks drydocking per annum (Off hire) ⇔ US\$280,000.
- **Total Annual Time Charter Cost = US\$7,300,000.**

Fuel Consumption costs

- **Load Speed:** The vessel's load speed can vary several knots depending on prevailing sea state conditions (significant wave height, wind, wave and current action).
- **Service Speed:** The service speed currently used for the MV Cabo Star is based on 83% mcr = 13.6 knots, which is used in the fuel consumption calculations in the section below.
- **Fuel Consumption MAIN ENGINES:** Using 2 ME @ 13.6 = 50 m³ per 24 hours.

- **Fuel Consumption- AUXILIARY ENGINES:**
 - Using 1 AE the fuel consumption rate is 4 m³ per 24 hours (No cargo operations)
 - Using 2 AE the fuel consumption is 8 m³ per 24 hours (during cargo operations)
 - Using 3 AE the fuel consumption is 12 m³ per 24 hours (during manoeuvres in port)

The fuel consumption cost calculations are based on the above consumption rates applied to the total round-trip time, as follows:

- Transit sailing time
- Vessel turnaround time in port.
- See table 2 showing nautical distance and transit times.

Table 5: Fuel Consumption Calculation for Transit Sailing per Roundtrip

Route	Distance in nautical miles	Transit time in hours @ 13.5 knots	Fuel consumption @ 50 m³/ 24 hrs	Fuel consumption in Transit Sailing @ \$3,920/ m³
<i>Guyana =>Trinidad</i>	399	31	65	254,800.
<i>Trinidad => Barbados</i>	251	19	40	156,800.
<i>Barbados => Trinidad</i>	251	19	40	156,800.
<i>Trinidad => Guyana</i>	399	31	65	254,800.
Total	1300	100	210	823,200

- Total Fuel Consumption per roundtrip= 823,200+62,720= \$885,920.
- Total Fuel Consumption per annum= 885,920 x 52= \$46,067,840.
- **Total Fuel Consumption in US\$ 6,875,797.**

Table 6: Fuel Consumption Calculation for Time Spent in Port per Roundtrip

Route	Maneuvering time in port @ 12 m³/ day	Cargo handling time in port @ 8 m³/ day	Non-cargo handling time in port @4 m³/ day	Total Fuel Consumed in Port @3,920/m³
<i>Guyana =>Trinidad</i>	2	8	2	12
<i>Trinidad => Barbados</i>	2	8	2	12
<i>Barbados => Trinidad</i>	2	8	2	12
<i>Trinidad => Guyana</i>	2	8	2	12
Total Time in port	8	32	8	48
Fuel Consumed in m³	4	10.7	1.3	16
@\$3,920 =	15,680.	41,813.	5,227.	62,720.

Port Costs

- Assume berthing fees and charges @US\$605 x 2 =1210 x 5 port calls per roundtrip x 52 weeks = 260 port calls per annum ⇔ US\$314,600.
- **Estimated total port costs = US\$314,600.**

Container Handling Costs

- Assume ro-ro container cargo handling costs at the rate of US\$ 250 per TEU, as follows:

- Guyana <->Trinidad (4,000 TEUs x US\$250) = US\$1,000,000.
- Trinidad <-> Barbados (6,000 TEUs x US\$250) = US\$1,500,000.
- Barbados <-> Trinidad (3,000 TEUs x US\$250) = US\$750,000.
- Barbados <-> Guyana (3,000 TEUs x US\$250) = US\$750,000.
- Trinidad <-> Guyana (6,000 TEUs x US\$250) = US\$1,500,000.
- Total ro-ro container cargo handling cost of 22,000 TEUs x 250 = US\$5,500,000.

Empty Chassis Storage Costs

- Based on US\$16.00 per day @ 2 days= US\$32 x 40 x 5 x 52 =US\$332,800.

Reefer Charges

- Based on 5 units plug in and 5 units plug out per port call x US\$14 = US\$140 x 5 = US\$700 x 52 =US\$36,400.

Insurance Costs

- **Equipment All Risks** based on 2.5% of the equipment replacement value.
- **Operator's Public Liability Insurance** based on US\$1000 per US\$1 million.
- **Charterer's Liability Insurance** based on US\$11,000 per US\$50 to US\$100 million

Shipping Agency Costs

- Shipping Agency's Commission fee based on 3% of the applicable freight rate per TEU = .05 x x US\$1500 x 22,000 = US\$990,000.

Estimated Annual Operating Cost

Table 7: Estimated Total Annual Operating Costs

Operating Cost Components	Total USD
Time Charter	7,300,000
Container Equipment	
Fuel Consumption	6,875,797
Pilotage and Towage	780,000
Mooring and Unmooring Lines	312,000
Maritime Services- Light dues	78,000
Container Cargo Handling	5,869,200
Ship Security Services	120,000
Container Tracking and Control	120,000
Shipping Agency Costs	990,000
Office Administration Costs	2,085,000
Insurance Costs	67,000
Total Annual Operating Costs	24,596,997

Projected Annual Revenue

Table 8: Projected Annual Revenue

Container TEUs	Freight Rate	Revenue
22,000	1,500	33,000,000
22,000	1,600	35,200,000
22,000	1,700	37,400,000
22,000	1,800	39,600,000
22,000	1,900	41,800,000
22,000	2,000	44,000,000

Conclusion and Recommendation

The model shows that under certain assumptions the introduction of a regional ferry service can be is economically and financially feasible and if sustainable in the long run can result in the promotion and expansion of containerized trade within the southern Caribbean region.

However, the vessel design, technical specifications and cargo handling capacity and capability must be adapted to provide a reliable liner shipping service consistent with the demand for containerized cargo transportation between the islands and able to compete with existing liner shipping services in the region.

Such a service is likely to close out any gaps in the existing liner shipping services within the southern Caribbean. Accordingly, the following design specifications are recommended for the acquisition of a suitable ro-ro container cargo ferry:

Vessel Design Characteristics and Cargo Transport Capacity: A ro-ro vessel with the following design characteristics:

- Length overall of 120 metres
- Breadth of 25 metres
- Draft of 6.5 metres (fully loaded)
- Deck storage of 1800 lane metres
- Truck and trailer, vans and vehicle cargo capacity 120 TEUs
- Cargo Deadweight capacity 6,300 tonnes
- 200 containers TEUs/ FEUs and 10 foot container units
- 120 wheeled chassis/ trailers
- 12 tractor cabs
- Accommodation for 12 sleeper cabins
- Accommodation cabins for 30 crew members
- Seating accommodation for 90 passengers.
- **Passenger common area facilities:** Seating lounges with big screen television, food and beverage cafeteria with dining area, public rest rooms and fitness facility.