Fleet Tactical Model

Fleet Tactical Model

Notional Design – N3
(180m ROPAX)

Revision History					
2	12 Jun 06	Hoistable Decks Added	P. Duguay	J. Volc	J. Volc
1	9 Mar 06	Executive Summary added	J. Volc	J. Volc	J. Volc
-	20 Oct 05	Issued for Comment	N. Murphy	J. Volc	J. Volc
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EXECUTIVE SUMMARY

The intent of developing Notional Designs reflects the need to provide realistic, achievable capacities within a given dimensional envelope (length, breadth, draft, etc.). The initial report presented a design which met the Strategic Model requirements for vessel capacity. Follow-on work using the Interim Tactical Model (ITM) has been based on actual vessel capacity as determined by the Notional Design presented herein.

The Strategic Model is a fleet-wide financial model using one year as its smallest time increment, and was designed to allow a comparison of different fleet configurations. Output from this model formed the basis for developing Notional Designs. To ensure the fleet's ability to meet peak demand periods during the summer season, a more detailed Interim Tactical Model was developed to analyse the three week summer peak period. The Interim Tactical Model analyses this period and its associated traffic offering based on detailed inputs for vessel lane configurations (width, length, and height).

This report describes the characteristics of a vessel that has been used in the Interim Tactical model, which now reflects a revised design of the same dimensions as defined by the strategic model, but which now incorporates hoistable decks to meet peak demand periods through to 2030.

The 180m ROPAX designated as "N3" has been engineered in sufficient detail to confirm that the salient requirements as determined by the Strategic Fleet Model and the Interim Tactical Model have been met. The key output of this effort is the vehicle deck plans as they are a required input of the Interim Tactical model. The data presented is not meant to be a fully developed concept design; however, it does contain sufficient information for the preparation of a valid functional specification.

N3 - Principle Particulars .

LOA 180.000m
Breadth..........................27.600m
DEPTH (1dk) 9.000m
draft 6.500m

Disp (SW)...................... 18,089t
DWT 4,678t

PAX 1,000
LnM .... 2,379m (Hoistable Decks Stowed)
LnM .... 3,513m (Hoistable Decks Deployed)

N3 meets or exceeds the initial requirements set out by the Strategic Model runs and has sufficient displacement, power and stability in the configuration presented.

An “Outline Specification” has been provided in Appendix ‘A’.

1.0 INTRODUCTION

1.1 General

The Tactical Model requires dimensionally correct ramps and vehicle deck plans to simulate the loading carriage and discharge of vehicle traffic. In order to establish these prerequisites with an acceptable level of confidence, various dominant characteristics must be addressed in sufficient detail to provide proof of concept.

The vessel described in this report has been engineered in sufficient detail to ascertain that the salient requirements can be met in a configuration resembling the arrangement shown. The data presented is not meant to be a fully developed concept design; however, it does contain sufficient information for the preparation of a valid functional specification.

1.2 Background

The Strategic Fleet Model considered 10 options for the composition of the Marine Atlantic fleet. The options ranged from simply maintaining the status quo to replacing the fleet with four new ROPAX vessels. N3 is loosely based upon Option 4 and recommendations from Marine Atlantic.

This report looks in more detail at the parameters that define this vessel for the Tactical Model and Interim Tactical Model.

2.0 NOTIONAL VESSEL DESIGNS

2.1 Aim

To provide rough order-of-magnitude (ROM) evidence of the suitability of the selected vessel parameters using the criteria noted below. The engineering for the notional design is to avoid the use of first principles techniques and to focus on using data from existing designs to minimize the potential for introducing unusual characteristics.

2.2 Criteria

The suitability of the vessel shall be gauged against the following criteria:

1. Adequate vessel vehicle capacity (as determined by the Strategic Model and the Interim Tactical Model);
2. Adequate vessel displacement and stability against SOLAS 90 criteria;
3. Adequate speed/power (as determined by the Strategic Model);
4. Adequate manoeuvrability
5. Adequate space for passenger amenities (determined by deck area)
    a) Access and egress
    b) Passenger lounges (TV lounges etc)
    c) Galley
    d) Dining Areas
6. Adequate space for crew (determined by deck area)
    a) Lounges
    b) Cabins
    c) Dining Areas
    d) Change Rooms
7. Adequate tankage (as determined by MAI requirements for frequency of fuelling and watering)

See Section 6.0 for the summary of the results

3.0 DESCRIPTION OF VESSEL

3.1 General Characteristics

The notional design has been designated N3 for convenience.

The general particulars of N3 are as follows:

	N3
LOA:	180 m
PAX:	1,000
Lane metres (Fixed Decks):	2,379m
Lane metres (Hoistable Decks):	1,134m
Lane metres (Total):	3,513m
AEU (Fixed Decks):	445
AEU (Hoistable Decks):	212
Speed:	22 knots
Power:	24,000 kW

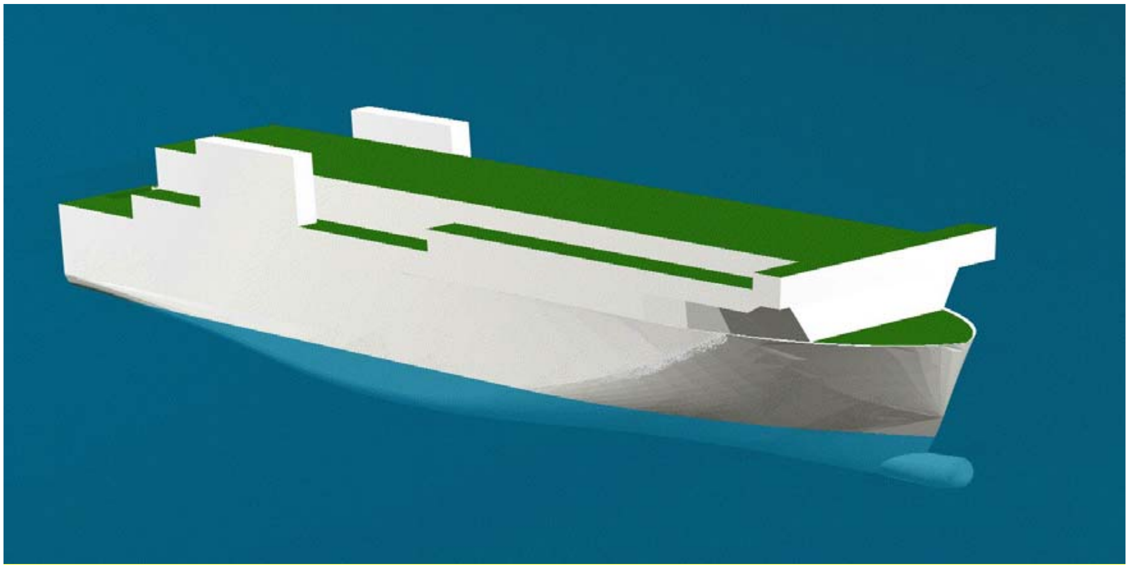
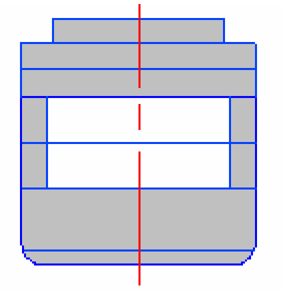


Figure 1 - **N3** - 180m ROPAX

3.2 General Arrangement

The general arrangement of this ROPAX vessel is quite similar to the arrangement of MAI existing vessels – the Caribou and the Smallwood. This effective design has been proven a good fit for the Marine Atlantic operation, and therefore will be used as a basis for the new design.



The vehicle deck arrangement features two side casings on both vehicle decks, as shown in Figure 2 and hoistable decks on both vehicle decks. The side casing arrangement provides superior vehicle access, simplified hoistable vehicle decks and a higher passenger vehicle (PRV) capacity. An open deck area has been provided at the aft end of the upper vehicle deck for dangerous/restricted cargoes. This area can also be used for refrigerated trailers that need to run diesel compressors during the voyage.

Figure 2 – Midship Section

The vessel configuration has been selected to meet traffic demand to 2020. In order to meet demand to the "End of Life" of the vessel (~2030), hoistable vehicle decks have been added. When deployed, the hoistable decks offer an additional 1134 metres of 2.5m wide lanes with a clear height of 2.2m for a total of 515 AEUs (Cars) 5.34m long, while maintaining a full-height 3.0m lane capacity of 20 tractor-trailers.

The passenger spaces have been separated into 2 zones. Dining areas, snack bars and lounges with tables are situated forward and aft of the TV lounges. Passenger cabins are located on two decks at the forward portion of the superstructure.

Crew change rooms, lounges, dining areas and cabins occupy the upper deck along with offices and administrative spaces.

HVAC will be provided through centralized air handling units distributed to match the main fire zones. Local units for the bridge, machinery control room, engineer's office and galley will likely be required.

The arrangement of the vessel is provided in Figure 3 to provide objective evidence that a configuration meeting the criteria noted in section 2.2 is possible. The layout is not considered a best fit, but nonetheless, does embrace concepts that have proven themselves in previous vessels.

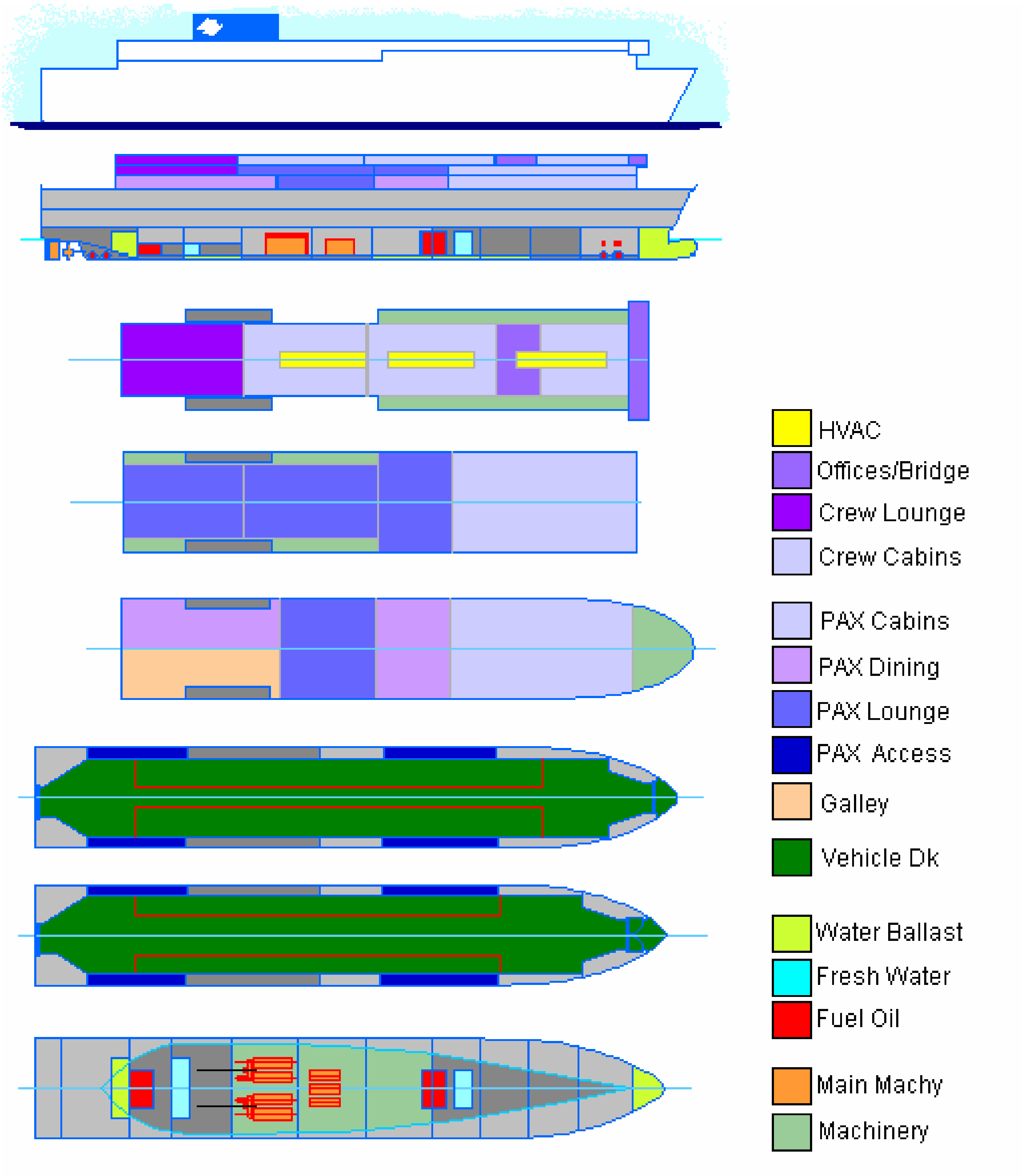


Figure 3 - General Arrangement

3.3 Machinery Selection

3.3.1 Assumptions

The docking in PAB should not be an issue as N3 is approximately the same size as the Caribou and the Smallwood and fitted with more thrusters.

3.3.2 Theory for Mechanical Option

3.3.2.1 Main Engines

Approximately 24,000 kW of propulsion power is required to maintain a speed of 22 knots. In addition to this power, an additional 4800 kW of power for the seaway load, and 1400 kW for growth results in a total power requirement of 30,200 kW. Utilizing four engines to cover the total load, results in a power requirement of approximately 7,550 kW per engine.

The engine selected to cover this load is the MaK 9M43 (8,100 kW) marine diesel engine.

3.3.2.2 Shaft Generators

Shaft generators require the capacity to run four thrusters with a combined load of 4,480 KW (4 x 1,120 KW). Each generator will be set up to operate 2 thrusters each (for a total of 4). This means each PTO generator requires the capacity for 2,240 KW (2 x 1,120 KW).

Operating 4 thrusters is an emergency condition. Normal operation will be with 2 or 3 thrusters (2,240 kW), distributed over 2 shaft generators requiring 1,120 kW.

3.3.2.3 Propulsion Control System

A necessary propulsion control system shall be setup to limit the load on the main engines. This will prevent overloading and maintain high efficiency during various conditions.

With the PTO generators engaged, the main engines will be running at 500 rpm constant speed. They will power the CP propellers as well as the shaft generators for the transverse thrusters. As there is less propulsion power demand during manoeuvring, only one main engine is to be clutched on each shaft. The CP propeller pitch will be limited so that one main engine will only supply about 40% of its power for propulsion. This will allow each PTO generator to power two thrusters via a 2,240 kW shaft generator if it is required.

Due to the cyclic nature of the RPM of the propulsion system when operating in a high sea state, the use of shaft alternators is not a good method of providing clean electrical power during transit.

Two dedicated switch boards will be installed to supply power to the four thrusters. With the PTO generators disengaged, the propulsion system will be operated at a pitch and speed combination mode. This way, during transit, the propulsion system will always be running at high efficiency which results high fuel efficiency and less emission. The ability to draw on a large reserve of power will help the ferry to meet the schedule under different weather condition and/or circumstances.

3.3.2.4 Diesel Generators

Diesel generators are required to handle a ship service load of approximately 2206 kW. This will be handled by three generator sets each with a power output of 1710 kW. This allows for two gensets in operation with one backup. One of these generator sets is then sufficient to handle harbour load estimated to be about 1650 kW.

Gensets chosen to meet power requirements for ship service and harbour load is Mak 6M25 with a 1710 kW output at the generator.

	Maximum
Propulsion Power @ 22 kn	24 MW
Seaway Load	4.8 MW
Growth +5%	1.4 MW
TOTAL	**30.2 MW**

4 x MaK 9M43 = 32.4 MW

Figure 4 - MaK 9M43

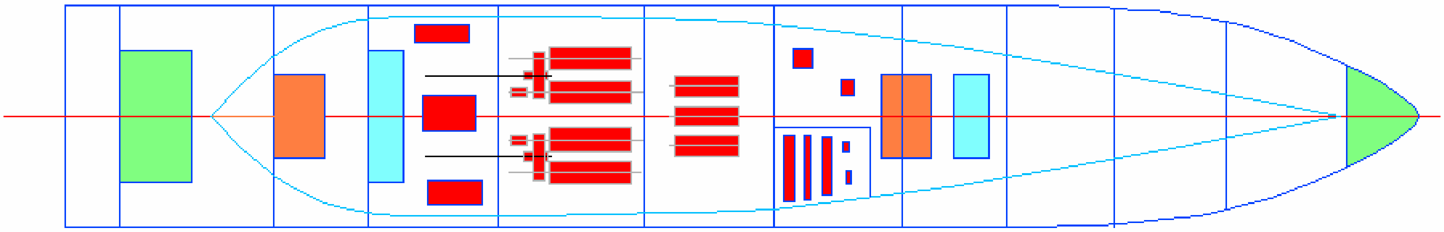


Figure 5 - Machinery Layout

4.0 SUITABILITY OF THE DESIGN

4.1 Vehicle Capacity

The measured vehicle capacity for N3 is 2,379 LnM on the main and upper decks + 1,134 LnM on Hoistable Decks, as shown in Figure 5. LnM correspond to 2.5m wide lanes.

Loading Scenario 0 – All Passenger Vehicles (LT0) – Main & Upper Deck Hoistable Decks Deployed

Deck	Free Height	AEUs (Cars) [2]	Lanem[1]	Tractor-Trailers[3]
Main	4.50 / 2.20	291	0	0
Upper	4.50 / 2.20	366	0	0
		657	0	0

Loading Scenario 1 – High Volume of Passenger Vehicles (LT1) – Main & Upper Deck Hoistable Decks Deployed

Deck	Free Height	AEUs (Cars) [2]	Lanem[1]	Tractor-Trailers[3]
Main	4.50 / 2.20	164	443	20
Upper	4.50 / 2.20	351	0	0
		515	443	20

Loading Scenario 2 – 50/50 Mix Passenger / Commercial Vehicles (LT2) – Upper Deck Hoistable Deck Deployed, Main Deck Hoistable Deck Stowed

Deck	Free Height	AEUs (Cars) [2]	Lanem[1]	Tractor-Trailers[3]
Main	4.50 / 2.20	0	911	40
Upper	4.50 / 2.20	351	0	0
		351	911	40

Loading Scenario 3 – High Volume of Commercial Vehicles (LT3) – Main & Upper Deck Hoistable Decks Stowed

Deck	Free Height	AEUs (Cars) [2]	Lanem[1]	Tractor-Trailers[3]
Main	4.50 / 2.20	0	912	40
Upper	4.50 / 2.20	0	998	45
		0	1910	85

1. Lanem reflects full-height lanes 3.0m wide
2. AEU values based on 5.34m long x 2.5m wide AEUs
3. Tractor-Trailer quantities based on 21.24m long vehicles

This vehicle deck configuration has the ability to carry the following vehicle mix :

657 Cars (5.34m AEUs) or,
515 Cars (5.34m AEUs) + 20 Tractor Trailers (21.24m), or
351 Cars (5.34m AEUs) + 40 Tractor Trailers (21.24m), or
0 Cars (5.34m AEUs) + 85 Tractor Trailers (21.24m), or
0 Cars (5.34m AEUs) + 30 Drop Trailers (15.24m) + 62 Tractor Trailers (21.24m)

90 TT can be accommodated if some units are backed into their final position

Hoistable decks may be deployed individually per side per deck, as desired to best suit required loading (ex. only the port upper deck). When deployed however, the entire length of the deck must be deployed. Forward and aft sections of the hoistable decks will be configured as full-width loading / unloading ramps and can be raised to the deployed position while loaded with vehicles.

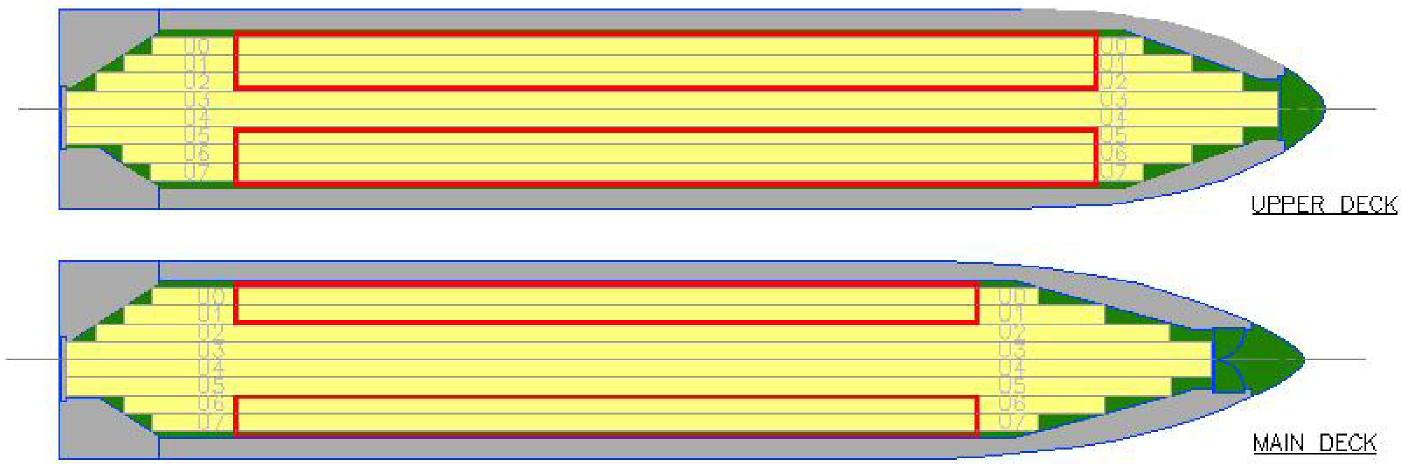


Figure 6 - Lane Metres (2.5m Lanes) – Outline of Hoistable Decks Shown in Red

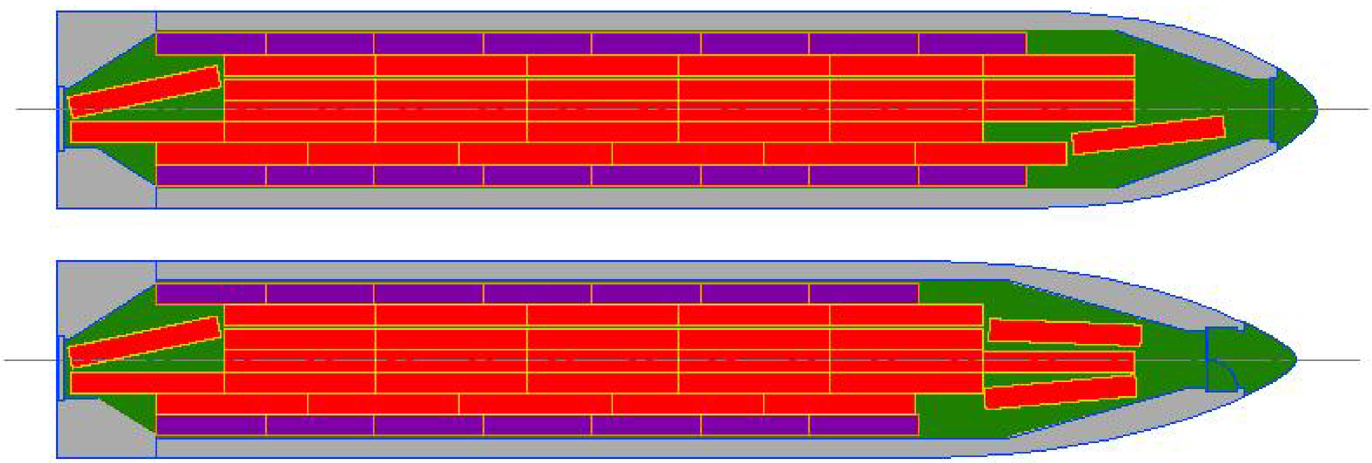


Figure 7 - Combined DT & TT Load

4.1.a Vehicle Access : The vehicle decks are accessed by main and upper deck stern ramps that are offset to align with the Port Aux Basques and Argentia linkspans. Single part embarkation ramps with hydraulically actuated aprons will be similar to the existing arrangements on the MAI vessels.

The forward end of the vehicle decks will be serviced by a bow visor protecting skewed 2 part ramps that will also act as internal WT doors. The bow ramps are skewed to align with the North Sydney linkspan.

An internal ramp will be required to service the single level linkspan in Argentia. It is recommended that MAI fit a movable ramp that can be deployed when required to provide access on/off of the upper vehicle deck when in Argentia. The model will consider the two new vessels fitted with this ramp to provide flexibility in the allocation of vessels to routes.

4.2 Displacement and Stability – SOLAS 90

4.2.a Lightship

The lightship was estimated using design coefficients and cross checked using Watson & Gilfillan. It is expected that the accuracy for the individual line items may be in the order of ±15%, while the overall total should be within ±10% as there is more dependable data available on total lightship than there is for its constituent parts.

Steel	9,282t.
Machinery	900t.
Propulsion	77t.
Auxiliary	823t.
Outfit	3,229t.
Lightship	**13,411.**

The steel weight is 69% of the total lightship and was subject to a final check based on total enclosed volume. As shown below, N3 lies in the primary design lane. This indicates that there is a sufficient allowance to add material for ice class assuming that a well-designed, efficient superstructure will be incorporated.

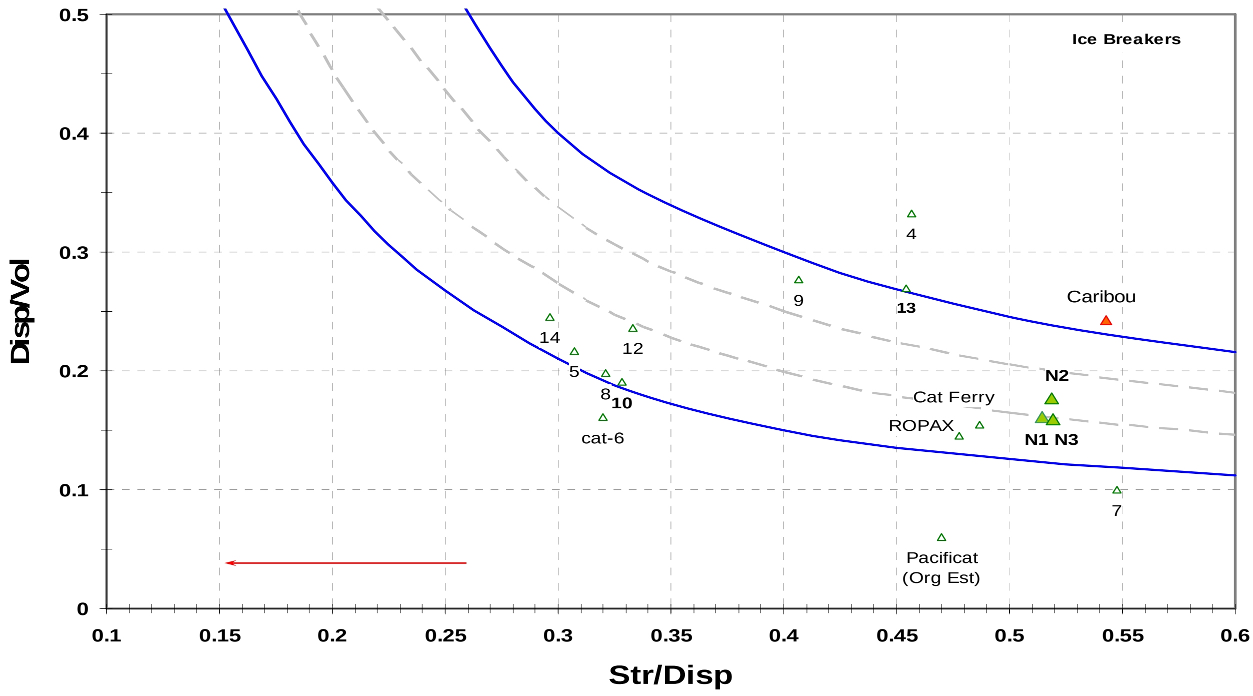


Figure 8 – Structural Density

4.2.b Deadweight

The deadweight was derived from the values in Marine Atlantic's trim & stability books, tank volumes calculated from the notional design and by laying out vehicles on the vehicle decks.

Crew, Effects & Provisions	(tonnes)		
CREW AND EFFECTS	15		
STORES AND PROVISIONS	100		
TOTAL	**115**	t	
Tankage			
FUEL OIL (FO)	674		
FRESH WATER (FW)	486		
SALT WATER BALLAST (WB)	50		
TOTAL	**1,210**	t	
MISC TANKS (LO, BW, GW)	**111**	t	
Cargo Deadweight			
	WEIGHT (tonnes)	**# TT**	**# Autos**
UPPER DECK	1,645	47	*0*
LOWER DECK	1,505	43	*0*
DECK CARGO TOTAL	**3,150**	**90**[1]	***0***
PASSENGERS	**92**	t	
Total Deadweight	**4,678**	tonnes	

Note 1 : 90 TT is the maximum loadout that can be carried. Some of the TT's need to be backed into their final position to achieve this.

4.2.c Hull Form

The hull form was roughed-in to develop the required displacement. Little time was spent on fairing or shape refinement.

Lightship	+	Deadweight	=	Displacement
13,411t	+	4,678 t	=	18,089 tonnes

A small amount of adjustment was made as a concession to minimizing resistance (see section 4.3) but, fundamentally, once Fleetway had established that the prerequisite displacement could be met with a reasonable form the effort was suspended. Figure 9 shows the general shape of the hull.

4.2.d Stability

The hull was modelled in Rhino and exported in GHS format for analysis. Watertight compartments and tanks were modelled based on a two compartment damage requirement and the vessel was loaded to check capacities, draft & intact stability in the Deep Departure Condition. Deductions for seabays and thrusters tunnels were ignored as were additions for all minor tanks.

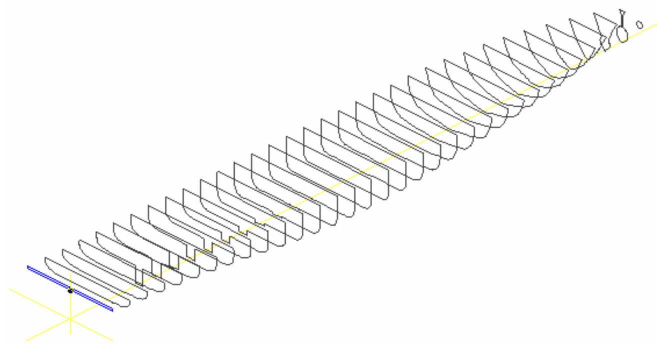


Figure 9 - Hull Sections

The vessel was then checked for compliance against damaged stability using the Deep Departure Condition as the starting point. As expected, flooding the two machinery spaces provided the worst damaged condition. Small adjustments to the positions of the bounding transverse watertight bulkheads were required to achieve compliance with the SOLAS90 requirements.

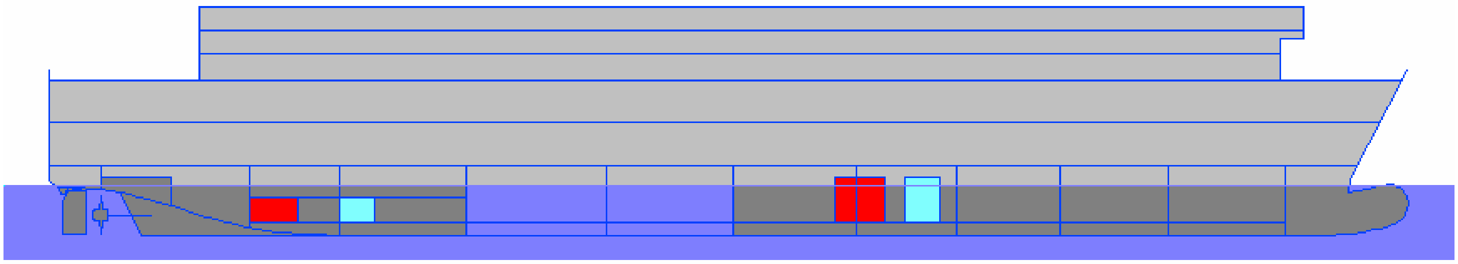


Figure 10 - Worst Damage Case

4.3 Speed and Power

After several iterations it was recognized that a design speed of 23 knots may not be required to meet the demand. This was checked and confirmed using the Interim Tactical Model. The end result was a reduction in service speed to 22knots. This change reduced the power demand by 13%.

The hull form characteristics are driven primarily by the need to provide adequate displacement at the prescribed draft. It is considered quite likely that the resistance will be reduced by 5% to 12% by refining the hull geometry and using a more precise analytical tool.

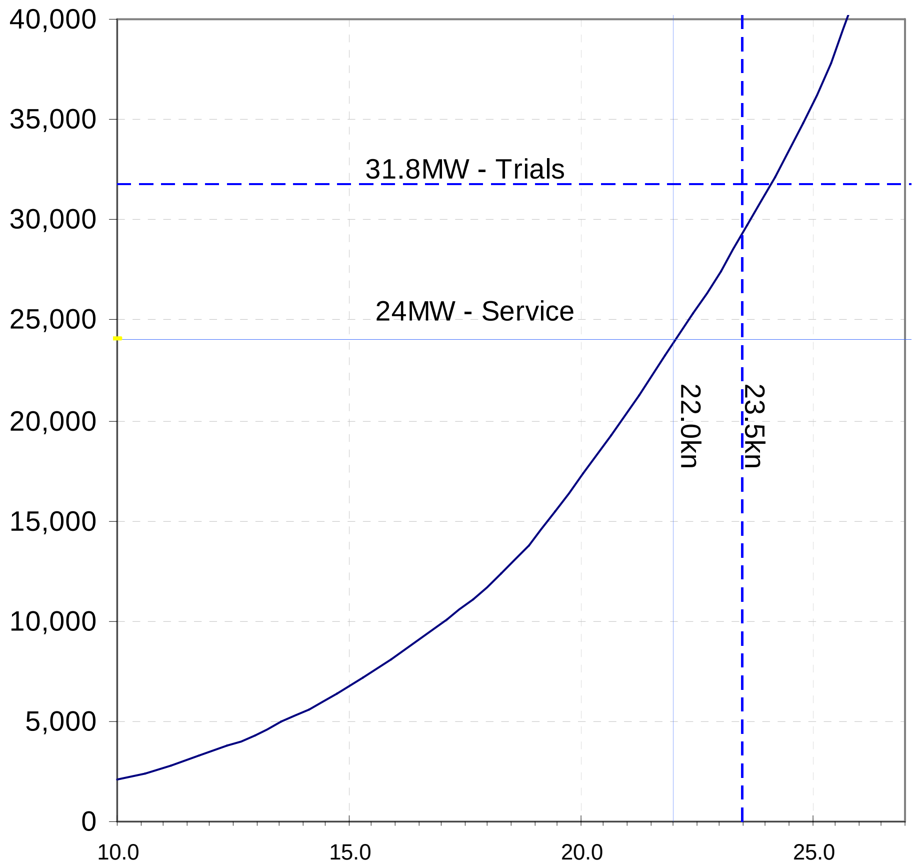


Figure 11 - Speed Power Curve

The curve in Figure 11 was calculated using the Holtrop & Mennen algorithm, corrected using data from a similar sized large ferry. Deductions for skeg, thrusters and stabilizers have been included.

4.4 Manoeuvrability

Given the fact that Marine Atlantic has no real problems with respect to manoeuvrability on the Caribou and the Smallwood, there are no problems anticipated with N3 as the vessel is approximately the same size and has more thrusters.

4.5 Passenger Space and Amenities

Ultimately, the balance between cabin and lounge/dining space will be decided by Marine Atlantic. The arrangement provided demonstrates that there is adequate space for the services that Marine Atlantic may require.

4.5.a Access and Egress

Passengers will access the vessel through stairways located in the casings port and starboard. Special-needs passengers can access elevators port and starboard. Walk-on passengers will access the vessel via the shuttle van as is common practice presently.

4.5.b Passenger Lounges

Passenger deck areas for cabins, lounges and dining are larger than those of *Caribou* and *Joseph and Clara Smallwood*. In total 14% more deck space is available for lounges, snack bars, video theatres and dining rooms than is currently provided on the *Smallwood*. In total, N3 has 6,600m^2 of deck space available.

4.5.c Galley

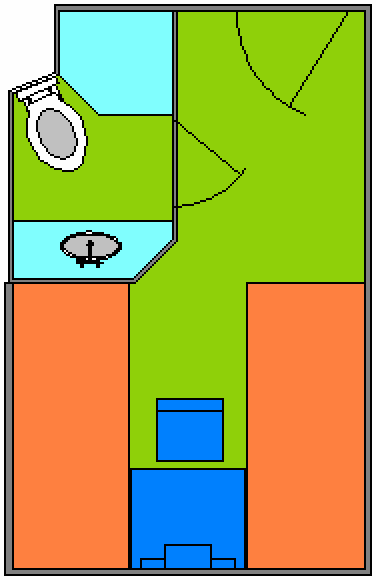
Space for the galley and provisions stores has been shown at the aft end of the lower passenger deck to emulate the existing Super Ferries. This has the added advantage of having good access to the machinery casing for services and exhaust. A total of 522m^2 of space (as compared with 550m^2 on the *Caribou* & *Smallwood*) has been shown as being dedicated to galley services and provisions.

4.5.d Dining Areas

Passenger dining areas have been included in section 4.5.b as the delineation between lounges and dining areas is entirely at Marine Atlantic's discretion. As noted in 4.5.b, ample space has been identified.

4.5.e Passenger Cabins

Space for a total of 200 passenger cabins has been arranged over 2 decks. The cabin arrangements found on Marine Atlantic vessels are presently quite compact and efficient and have not been altered in any material way. The allocation of space is based on a typical 4 passenger cabin as shown.



Larger cabins will be required for Special-needs passengers. One of these could be provided with a dedicated air supply/exhaust to act as an infirmary. Marine Atlantic may elect to have pairs of cabins fitted with connecting doors for larger families.

The space that has been provided in N3 also includes 1,000m^2 for "Rent-a-Bunk" compartments as is found on the *Smallwood*.

4.6 Crew Space and Amenities

4.6.a Change Rooms, Lounges & Dining Area

Space for crew lounges, dining areas and change rooms has been increased above that provided on the *Caribou* and *Smallwood*. Space for lounges and change rooms has been allocated on the upper deck, aft. This deck has 672m^2 available as compared to the 510m^2 available on the *Smallwood*. It is anticipated that this deck could provide the dining room along with an activity room with TV lounges, reading areas, change/locker rooms etc. as desired by MAI.

4.6.b Cabins

The crew cabin area has been assigned using a more compact cabin arrangement. It is anticipated that the crew could be accommodated in single cabins should Marine Atlantic find this advantageous.

	Smallwood	N3
Crew	77	77
Crew Cabins	41	41
Area of Cabin	11.3 m^2	9.0 m^2
Area of Cabin	786 m^2	1,146 m^2

The example provided indicates what is possible should the need arise.

4.7 Tankage

Based on the their Trim & Stability books, the existing Super Ferries (*Smallwood & Caribou*) both have excess tankage capacity for their intended service. The volume of fuel oil and fresh water has been reduced as shown below.

	Caribou	N3
Fuel Oil	1,474 m^3	674 m^3
Fresh Water	755 m^3	486 m^3
Water Ballast	1,453 m^3	1,693 m^3

Fleetway has rationalized the volumes based on conservative FW consumption values and relatively detailed Fuel Oil consumption following the methodology in DDS-200. The basic premise used by Fleetway is that Marine Atlantic will take on water nightly and will re-fuel after 6 sailings. Additional water and fuel has been allocated based on operating all services excluding propulsion for 3 days (ex: stuck in ice).

Water ballast has been distributed as fore and aft trim tanks and double bottom tanks. The volume has been set to reproduce those of the *Caribou*. They are, of course, easily changed and have no material impact on the Tactical Model.

5.0 VESSEL COST

Marine Atlantic requested budgetary quotes from several European shipyards. The resulting data has been used to determine the cost of the 180m ROPAX of CDN $195M (including duty, taxes, and a CDN $5M allowance for hoistable decks).

Appendix A contains an outline specification that Marine Atlantic may wish to submit to suitable builders capable of providing a budgetary cost estimate in a reasonably short period of time.

6.0 CONCLUSIONS

The notional design N3 meets or exceeds the requirements as set out in the Consolidated Statement of Work (ref.2) and the Interim Tactical Fleet Model (ref.5) with sufficient capacity to meet demand to 2030 with four (4) vessels in the fleet.

	Requirement	**N3**
1. Vessel vehicle capacity	As required to meet peak demand to 2030	2,379 LnM+1,134 LnM on Hoistable Decks
2. Vessel displacement and stability	SOLAS90	SOLAS90
3. Speed/Power	22kn	22kn
4. Manoeuvrability	Safely dock in PAB	Safely dock in PAB
5. Passenger amenities spaces	5,705m^2	6,600m^2
6. Crew spaces	2,630m^2	2,301m^2
7. Tankage		

References

1. Marine Atlantic, **Strategic Fleet Model**,
Fleetway Inc. Document: 10264900-1, Revision 3 (Doc-12), 2 February 2005

2. Fleet Tactical Model, **Consolidated Statement of Work**,
Revision 3, 09 Sept 2005

3. Watson & Gillfillan**, Some Ship Design Methods**,
Royal Institute of Naval Architects, 1976

4. Holtrop & Mennen, **An Approximate Power Prediction Method**,
International Shipbuilding Progress, 1982

5. Marine Atlantic, **Interim Tactical Fleet Model**,
Fleetway Inc. Document: 10290030-1, Revision 0, 22 September 2005

Appendix A

Outline Specification for 180m ROPAX

0.0 General

The vessel shall be designed to provide a safe, comfortable environment for the passengers and crew given the hostile nature of the intended operating environment.

0.1 Principle Particulars

LOA................180.000m.	
Breadth ....27.600m.	(Estimate)
DEPTH (1dk) .....9.000m.	(Estimate)
draft....................6.500m.	(Design)
Disp (SW) ....18,089.	(Estimate)
DWT...................4,678t.	(Estimate)

PAX.............1,000
LnM.............2,379m + 1,134m on hoistable decks (total of 3,513m of 2.5m wide lanes)

0.2 Regulatory Requirements

0.2.1 Transport Canada

The vessel shall meet all applicable Transport Canada Requirements for a Class II vessel on Short International Voyages.

0.2.2 Classification Societies

The vessel shall be classed under either Lloyd's Register or Det Norske Veritas as :

✠100A1 Passenger Vessel Ice Class I AA AMS

0.2.3 International Regulations

The vessel shall meet all applicable SOLAS90 requirements.

0.3 Performance

0.3.1 Speed

0.3.1.1 The vessel shall have a trials speed of at least 23.5knots.

0.3.1.2 The trials shall be conducted at the full load displacement, in calm water with less than 15knots of wind.

0.3.1.3 All normal services shall be operational during trials.

0.3.2 Seakeeping

Using ISO 2631/3 (1985) guidelines, it shall be demonstrated, analytically, that in the Light Departure Condition, the vessel achieves lower vertical accelerations when compared to the MV "Caribou" in the Light Departure Condition.

0.4 Capacities

0.4.1 Passenger and vehicle capacities shall be as noted in section 7.0

0.4.2 Tank capacities shall be as noted in 8.0

0.5 Ambient Environment and Area of Operation

The vessel shall be capable of meeting all requirements while operating in the ambient conditions noted.

0.5.1 Environment

0.5.1.1 Air temperature : +35°C to -30°C
0.5.1.2 Water temperature : +25°C to -3°C
0.5.1.3 Relative Humidity : 50% to 100%
0.5.1.4 Wind : 0 to 100knots (docking in 0 to 40knots)
0.5.1.5 Ice Cover : 0/10 to 10/10 coverage, 0 to 100cm thick

0.6 Area of Operation

The vessel shall operate between North Sydney, Nova Scotia, Canada and Port Aux Basques and Argentia, Newfoundland, Canada.

1.0 Structure

1.1 General

The vessel's structure shall be designed to minimize the lightship KG while providing a robust hull capable of resisting the ice and seaway loads expected in the intended operating area.

1.2 Tank Structure

1.2.1 Inner Bottom : The vessel shall be fitted with a full inner bottom

1.2.2 Vehicle Decks : The vehicle decks shall not form part of any tank. This is to be accomplished through the use of readily accessible cofferdams between the vehicle deck and tank top.

1.3 Deck Structure : All decks shall be designed with a natural frequency that is either 20% greater than or 15% less than the propeller blade rate at the normal transit speed. All passenger deck structures shall have natural frequencies greater than 5Hz.

1.4 Aft End Hull Structure

1.4.1 The structure of the transom from the main vehicle deck down and the aftermost 8% LWL of the hull shall be designed using the same ice loads as the Bow Area to resist ice damage when backing into ice congested terminals.

1.5 Hoistable Vehicle Decks

1.5.1 The decks shall be designed for minimum weight and depth.

1.5.2 The decks shall be fabricated using 350 MPa steel.

1.5.3 The hoisting system shall incorporate multiple interlocks to ensure safe operation.

2.0 Propulsion & Manoeuvring

2.1 General

The vessel's propulsion shall be conventional geared diesel propulsion with four (4) engines powering two (2) shafts. The main generating requirements shall be met by multiple units.

2.2 Prime Movers

The engines shall operate on heavy fuel oil (IFO 180) and shall be capable of running on marine diesel (DFO). The engines shall be capable of meeting all IMO NOx & Smoke Standards.

2.3 Commonality

Marine Atlantic currently operates MaK 43 series engines in their fleet. It is desirable to maintain commonality with the existing machinery installations.

2.4 Propulsion Machinery

2.4.1 The minimum blade tip clearance shall be 750mm.

2.5 Side Thrusters

Two tunnel thrusters of at least 1MW each shall be fitted forward. Each shall be fitted with soft-start electric motors and controllable pitch propellers (CPP).

Two tunnel thrusters of at least 1MW each shall be fitted aft. It shall be fitted with soft-start electric motor and controllable pitch propeller (CPP).

2.6 Rudders

The vessel shall be fitted with twin Becker rudders operating directly behind the propellers.

3.0 Electrical

3.1 General

All electrical services shall be supplied from the main generators under normal operating conditions.

3.2 Harbour Services

Shall be provided from one (1) service generator.

3.3 Future Growth for Non-Propulsion / Manoeuvring Circuits

A growth margin of 20% shall be designed into each distribution panel and their feeder circuits.

4.0 Command, Control and Communication

4.1 The ship shall meet class and SOLAS requirements for periodically unattended machinery spaces.

4.2 Remote control of propulsors and manoeuvring thrusters shall be provided at the bridge centre console and both wheelhouse wing consoles. Each location shall have individual remote controls for each propulsor and each manoeuvring thruster. Each bridge console shall have a joystick for coordinated control of all propulsors and manoeuvring thrusters, in free-running and manoeuvring modes.

4.3 The engine manufacturers onboard and remote diagnostic system(s) including all extra engine sensors shall be fitted.

5.0 Auxiliary Systems

5.1 General

Wherever practical, the ship's services shall be designed with the following principle features:

a) designed for maintainability
b) unitized, modular construction
c) repair by replacement
d) primary components (ex: pumps, compressors, motors) sized for 30% margins on performance
e) redundancy provided by multiple, identical components
f) heavy walled piping for systems with corrosive contents
g) soil piping over-sized by 30% on diameter

5.2 HVAC

5.2.1 Internal Environment : The HVAC system shall be capable of maintaining all crew and passenger spaces within the values noted below:
5.2.1.1 Air temperature : 23°C ±2°C
5.2.1.2 Relative Humidity : 50% ±5%

5.2.2 Air handling units shall be located on the bridge deck and shall be divided by fire zone.

5.2.3 Individual air handling units shall be provided for the bridge, central galley, machinery control room and any engineering office located below the main deck.

5.2.4 All air handling units shall be automatically controlled by a central system operated from the machinery control room with display(s) in the Purser's office.

5.3 Fresh Water

5.3.1 Fresh water will be taken on board from shore-side facilities. There will be no water making facilities on board.

5.3.2 Water for humidifiers shall use recovered water from A/C units.

5.3.3 The fresh water distribution system shall be based on a large bore re-circulating ring main system for both hot & cold water systems.

5.4 Sewage

5.4.1 All toilets will be high-efficiency, low volume (1.6gpf) units.

5.4.2 All piping shall be heavy wall black pipe over-sized by 30% on diameter.

5.5 Garbage & Recyclables

5.5.1 Garbage and recyclables shall be collected and compacted at the main deck level.

5.5.2 Fume-tight chutes shall be provided from the central galley and other convenient locations on each passenger deck to the central compactors on the main deck.

5.5.3 The compactors will be commercial standard units capable of being removed by truck without using shipboard or truck-mounted cranes.

6.0 Outfit & Furnishings

6.1 General

The emphasis shall be on providing a functional, comfortable environment for the crew and passengers. All passenger and crew spaces shall have a robust, easily maintained finish. The interior design shall provide a simple, attractive décor utilizing subdued colors and durable fixtures.

The arrangement and details of the passenger and crew spaces shall be laid out to support the completion of all housekeeping tasks during the short period of time available while at the terminal.

6.2 Passenger Spaces

6.2.1 Lounges : Lounges shall have the following general features:

6.2.1.1 Seating areas – comfortable fixed seating

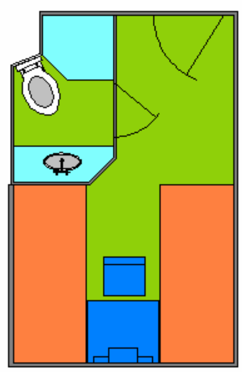
6.2.1.2 Snack/Games areas – seating and tables suitable for light meals, reading, writing or card/board games.

6.2.1.3 TV Lounges – large screen video displays, surround sound, comfortable seating with a clear view of the screens, subdued lighting, curtains for any exterior windows.

6.2.2 Cabins : Cabins shall be fitted as required by section 7.0

6.2.2.1 Each cabin shall have 4 berths, an ensuite WC/shower and a writing desk.

6.2.2.2 Special attention shall be paid to minimizing the sound levels in each cabin.



Passenger Cabin Sketch

6.3 Crew Spaces

6.3.1 Change Rooms / Lounges / Dining Areas

The crew shall be provided with change rooms, lounges and dining areas separate from all passenger spaces.

6.3.2 Cabins

The crew shall be provided with either single and/or double cabins with ensuite WC/Showers.

7.0 Vehicle & Passenger Requirements

7.1 Vehicles

7.1.1 Vehicle Types

7.1.1.1 Passenger vehicles shall range in size from motorcycles to cars to Class A Motorhomes towing trailers. These are all North American sized vehicles.

7.1.1.2 Commercial vehicles shall include single and dual axle trucks, tractor trailers and drop-trailers.

7.1.1.3 A standard tractor trailer will be considered to have the following characteristics:

7.1.1.3.1 Length : 21.240m
7.1.1.3.2 Width : 2.60m
7.1.1.3.3 Height : 4.15m
7.1.1.3.4 Weight : 35,000kg
7.1.1.3.5 Maximum Axle Load : 9,100kg

7.1.1.4 A standard drop trailer will be considered to have the following characteristics:

7.1.1.4.1 Length : 15.240m
7.1.1.4.2 Width : 2.60m
7.1.1.4.3 Height : 4.15m
7.1.1.4.4 Weight : 20,600kg
7.1.1.4.5 Maximum Axle Load : 9,100kg

7.1.2 Capacities

7.1.2.1 The vessel shall have over 2,000m. of standard, 2.50m. wide traffic lanes.

7.1.3 Access

Vehicles will access the vessel via bow and stern ramps

7.1.3.1.1 Stern Ramps shall be fitted at each vehicle deck.
7.1.3.1.2 The lower Stern Ramp shall be watertight.
7.1.3.1.3 A Bow Visor or outer Bow Doors shall be fitted to service each vehicle deck
7.1.3.1.4 Bow Ramps shall form watertight inner doors when in the stowed position
7.1.3.1.5 A hoistable internal ramp shall be fitted to service the upper vehicle deck from the lower vehicle deck.
7.1.3.1.6 The internal ramp angle shall not exceed 7° when deployed.

7.2 Passengers & Crew

7.2.1 Capacity

7.2.1.1 The vessel shall be designed and certified to carry 1,000 passengers
7.2.1.2 The vessel shall be designed and certified to carry 100 crew
7.2.1.3 The vessel shall have 200 passenger cabins.

7.2.2 Access

7.2.2.1 Passengers will access the vessel either from their own vehicles or via a shuttle bus from the terminal building

8.0 Tankage

8.1 Capacities (*Estimated*)

8.1.1 Fuel Oil : 550m^3
8.1.2 Fresh Water : 450m^3
8.1.3 Water Ballast :1,000m^3