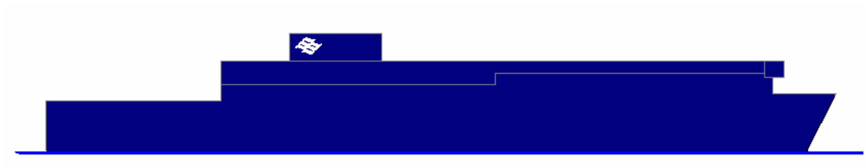
Fleet Tactical Model

Fleet Tactical Model



Notional Design – N2
(200m ROPAX)

Revision History					
5	12 Jun 06	Added Hoistable Decks	P. Duguay	J. Volc	J. Volc
4	9 Mar 06	Exec Summary	J. Volc	J. Volc	J. Volc
3	20 Oct 05	Re-Issued	N. Murphy	J. Volc	J. Volc
2	19 Aug 05	Re-Issued	J. Volc	P. Duguay	J. Volc
P0	10 Aug 05	Issued for Comment	J. Volc	P. Duguay	J. Volc
Revision	**Date**	**Revision Description**	**Originator**	**Checked**	**Approved**

FLEETWAY
155 -200 Chain Lake Drive
Halifax, NS B3S 1B3
Tel (902) 494-5700
Fax (902) 494-5792

Table of Contents

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 (Rev P0-4) 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 200m ROPAX, designated as "N2", 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.

N2 - Principle Particulars

LOA 200.000m
Breadth...................... 29.600m
DEPTH (1dk) 9.000m
draft 6.500m

Displacement (SW)....22,100t
DWT 5,400t

PAX 1,000
LnM ....3,224m (Hoistable Decks Stowed)
LnM .... 4,631m (Hoistable Decks Deployed)

N2 meets or exceeds all of 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. Option 6 considered acquiring three large new ROPAX vessels to replace the existing fleet.

The Strategic Model defined this new, large ROPAX as:

LOA:	200 m
PAX:	1,000
Lane metres:	2,951 m
AEU:	553
Speed:	23 knots
Power:	23.3 MW

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 (as determined by analysis prepared at Oceanic)
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 N2 for convenience.

The general particulars of N2 are as follows:

	N2
LOA:	200 m
PAX:	1,000
Lane metres (Fixed Decks):	3,224 m
Lane metres (Hoistable Decks):	1,407 m
Lane metres (Total):	4,631 m
AEU (Fixed Decks):	604
AEU (Hoistable Decks):	263
Speed:	22 knots
Power:	29,200 kW

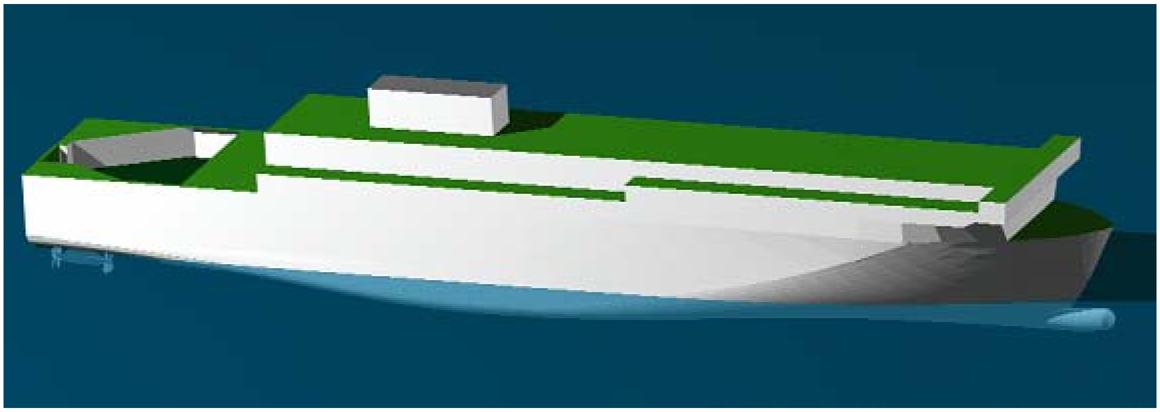


Figure 1 - **N2** - 200m ROPAX

3.2 General Arrangement

The general layout of spaces reflects the current thinking for larger ROPAX vessels. The lower vehicle space found on some of the European vessels has been omitted to reduce load/discharge times and to simplify the machinery arrangement. Should Marine Atlantic require a higher vehicle capacity vessel than the one being presented, lower hold options and the resulting costs may need to be considered. It must be stressed that the resulting vessel could no longer be considered 'conventional' as stated in section 2.1.

The vehicle deck arrangement features an offset center casing on both vehicle decks and hoistable decks on both vehicle decks. The single casing solution was adopted after analyzing the number of vehicles that could be carried using either side casings or an offset center casing. The side casing arrangement provides superior vehicle access, simplified hoistable vehicle decks and a higher passenger vehicle (PRV) capacity. The center casing had simplified passenger access, internal ramp structure and a higher tractor trailer (TT) capacity. Based on discussions with Marine Atlantic weighing these various compromises, the decision was reached to use the center casing, offset to one side to simplify TT loading & discharge. A large 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.

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 1407 metres of 2.5m wide lanes with a clear height of 2.2m for a total of 606 AEUs (Cars) 5.34m long, while maintaining a full-height 3.0m lane capacity of 36 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 located forward of the casing on the first passenger deck. 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 decks 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 2 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.

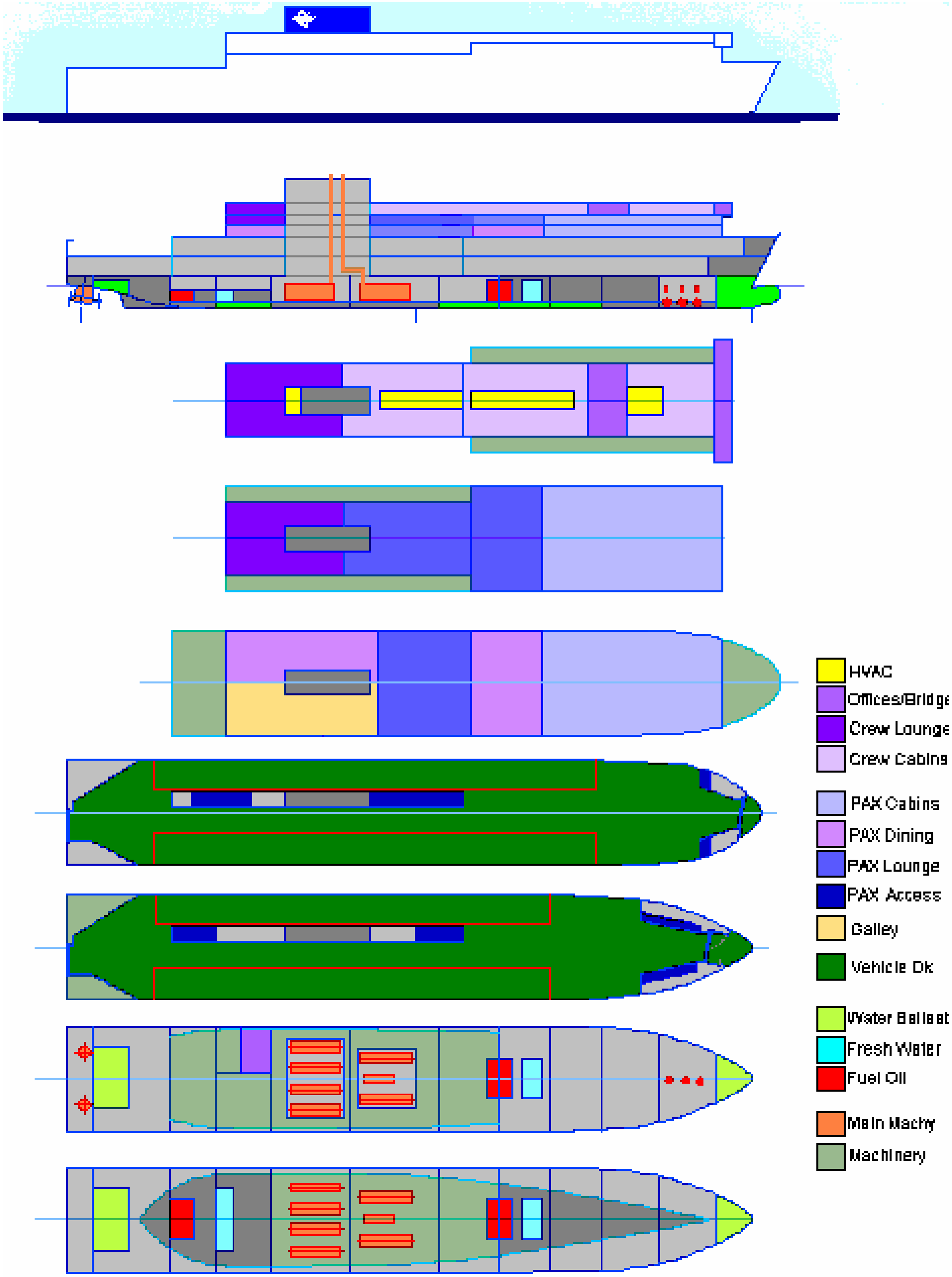


Figure 2 - General Arrangement

3.3 Machinery Selection

Based on a study prepared by Oceanic, interviews and data collected to-date, it would seem unlikely that a vessel this large could be safely docked in Port Aux Basques using a conventional geared diesel propulsion system. This assumption is of key importance. The outcome of it is that Fleetway has determined a Podded Propulsion system is a mandatory fit to provide the extra manoeuvring power that will be required.

For the purposes of this report it has been assumed that a podded propulsion system is the only viable alternative.

3.3.1 Assumptions

- Due to the size of the vessel, a podded propulsion system will be the only option capable of providing the manoeuvring thrust required to safely dock in Port Aux Basques.
- The transit service electrical load would be approximately 4 % greater than the summer sea load of MV *Caribou* (2200 kW) due to about a 4% increase in size based on volume;
- The ship would have the ability to run three thrusters (1120 kW each);
- The thrusters would be powered by the propulsion diesel generators; and
- A margin of 20% would be allowed for heavy sea conditions.

3.3.2 Theory for Diesel-Electric Option

The machinery and propulsion equipment selected is that of diesel electric propulsion. The ferry design requires 27.0 MW of power at the input of the propeller. Adding a sea-margin of 20% to this value increases the power requirement to 32.4 MW. From ABB's Azipod (Azimuthing Electric Propulsion Drive) project guide there is approximately 8% in losses between the generator and the propellers. Accounting for these losses results in a generated propulsion power requirement of 35 MW. The ship service load for this ferry design is expected to be approximately 2.3 MW which results in an overall power requirement of 37.3 MW from the main generators. Allowing for a growth margin of 10% sets the target total electrical generation capacity at 41.0MW.

A maximum of three thrusters would be required in operation at one time and will require a total of 3,360 kW (3 @ 1,120 kW). As thrusters are not necessary during transit, the sea-margin calculated will accommodate the thruster load during maneuvering.

In order to meet the varying service load requirements of transit and stand-by, it is recommended that six (6) diesel generators be utilized, each with a 6,000 kW continuous power rating. It is anticipated that this will provide the redundancy and flexibility required.

The MaK 8 cylinder M43C engine (8 M43C) has a rated output of 7.2MW. Operating 5 units at 95% rated capacity will fulfill the normal service and propulsion requirements with an 8% margin.

	Maximum	Service
Propulsion Power @ 22kn	27.0 MW	27.0 MW
Seaway Load	5.4 MW	
Losses (Elec) 8%	2.6 MW	2.2 MW
Services	2.3 MW	2.3 MW
Growth +5%	1.9 MW	
TOTAL	**39.2 MW**	**31.5 MW**
5 x MaK 8M43C (95%MCR)	34.2 MW	34.2 MW
margin	*-14.5%*	*8.0%*
6 x MaK 8M43C (95%MCR)	41.0 MW	41.0 MW
margin	*4.6%*	*23.3%*

Figure 3 - MaK 8 M43C

A smaller 1,800 kW generator will be needed to accommodate harbour load for periods spent alongside.

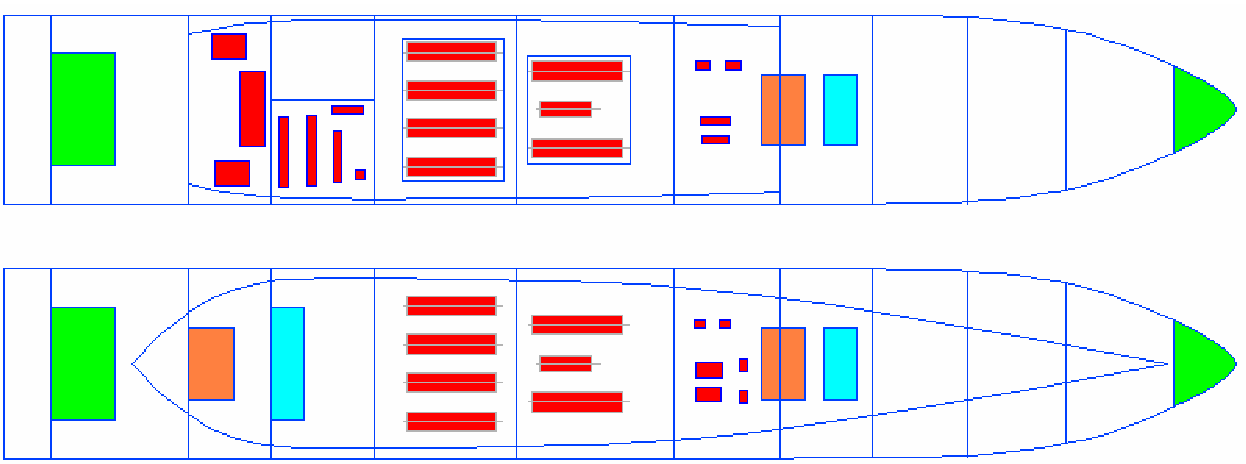


Figure 4 - Machinery Layout

4.0 SUITABILITY OF THE DESIGN

4.1 Vehicle Capacity

The measured vehicle capacity for N2 is 3,224 LnM on the main and upper decks + 1,407 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	415	0	0
Upper	4.50 / 2.20	452	0	0
		867	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	289	402	17
Upper	4.50 / 2.20	317	430	19
		606	832	36

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	10	1086	47
Upper	4.50 / 2.20	317	430	19
		327	1516	66

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	10	1086	47
Upper	4.50 / 2.20	10	1222	53
		20	2308	100

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 :

867 Cars (5.34m AEUs) or,
606 Cars (5.34m AEUs) + 36 Tractor Trailers (21.24m), or
327 Cars (5.34m AEUs) + 66 Tractor Trailers (21.24m), or
20 Cars (5.34m AEUs) + 100 Tractor Trailers (21.24m), or
20 Cars (5.34m AEUs) + 36 Drop Trailers (15.24m) + 74 Tractor Trailers (21.24m)

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.

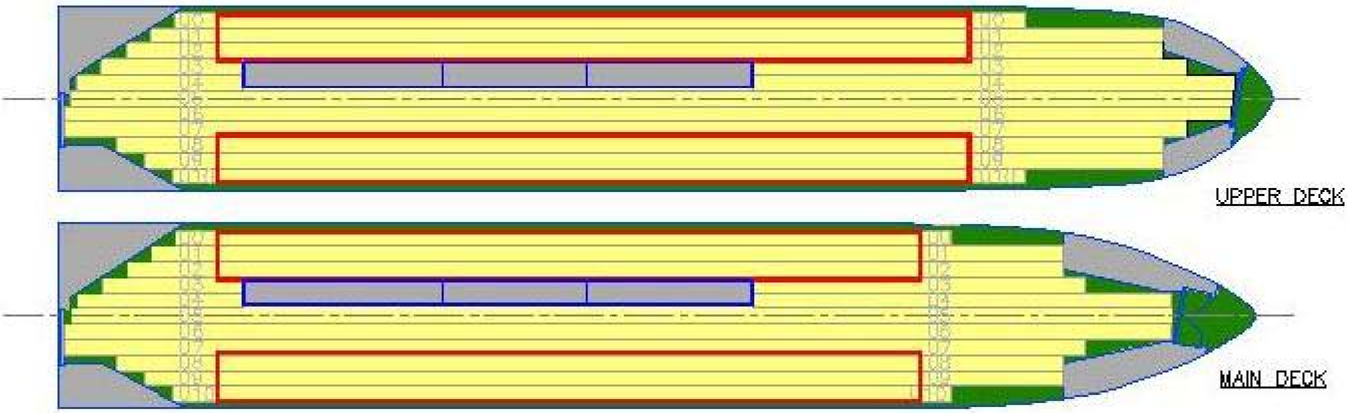


Figure 5 - Lane Metres (2.5m Lanes) – Outline of Hoistable Decks Shown in Red

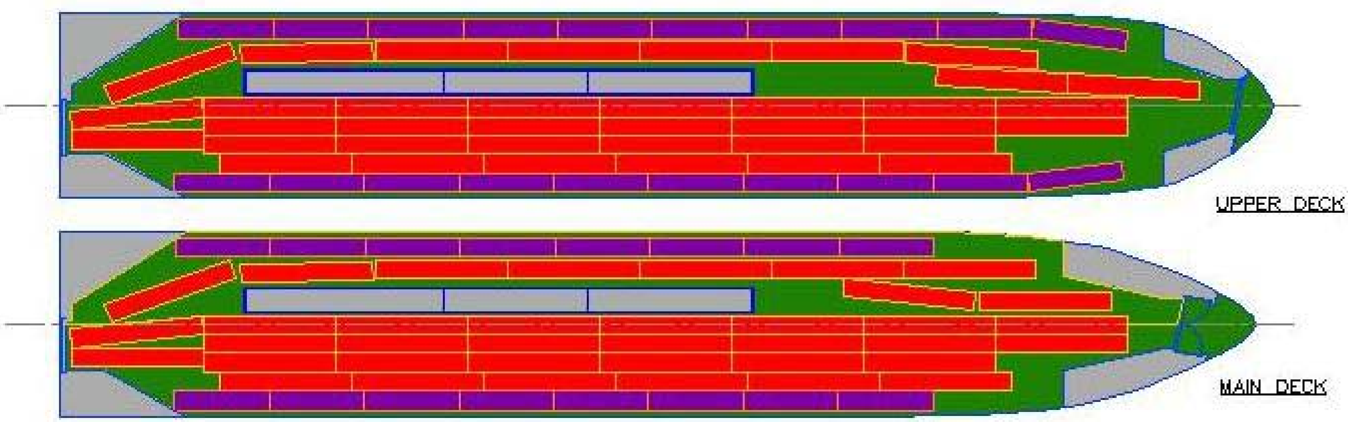


Figure 6 - Combined DT & TT Load

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.

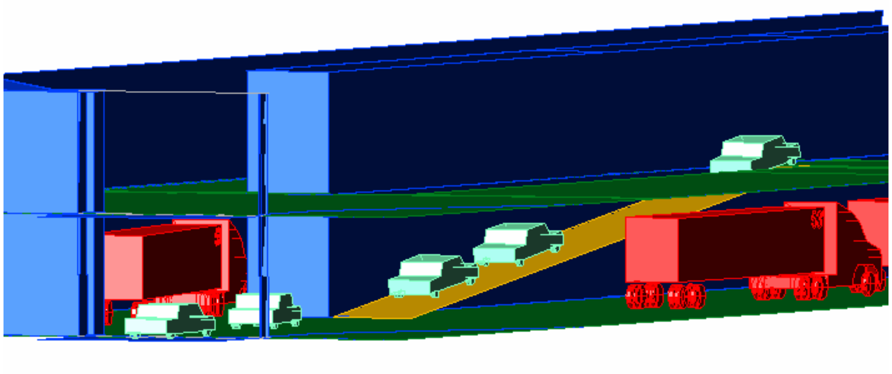


Figure 7 Ramps

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 all three new vessels fitted with this ramp to provide flexibility in the allocation of vessels to routes. Locating the ramp adjacent to the single offset casing allows passenger vehicles to be loaded on the upper vehicle deck while drop trailers are being loaded on the main deck to port and tractor trailers, overheights, etc are loaded on the main deck.

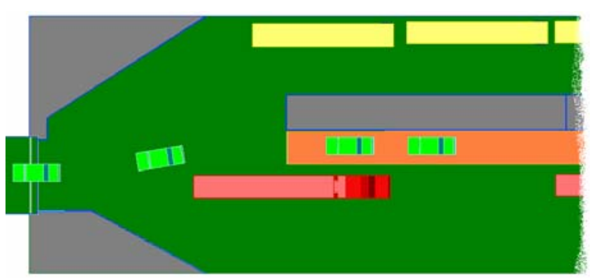


Figure 8 - Internal Ramp

4.2 Displacement and Stability – SOLAS 90

4.2.a Lightship

The lightship was estimated using design coefficients and cross checked using Watson & Gilfillan, tuned for large ferries. 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	11,440 t
Machinery	1,210 t
Propulsion	508 t
Auxiliary	702 t
Outfit	4,070 t
Lightship	**16,719 t**

The steel weight is 68% of the total lightship and was subject to a final check based on total enclosed volume. As shown below, N2 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.

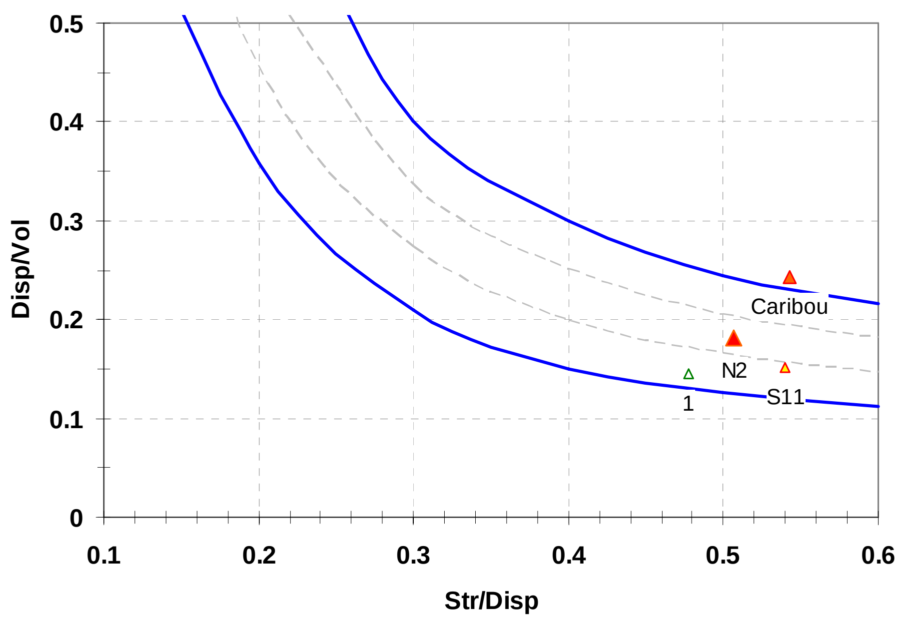


Figure 9 - Structural Density

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	2,012	57	*0*
LOWER DECK	1,836	52	*0*
DECK CARGO TOTAL	**3,848**	**109**[1]	***0***
PASSENGERS	**92**	t	
Total Deadweight	**5,376**	tonnes	

Note 1 : 109 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
16,719 t.	+	5,376 t.	=	22,095 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 10 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.

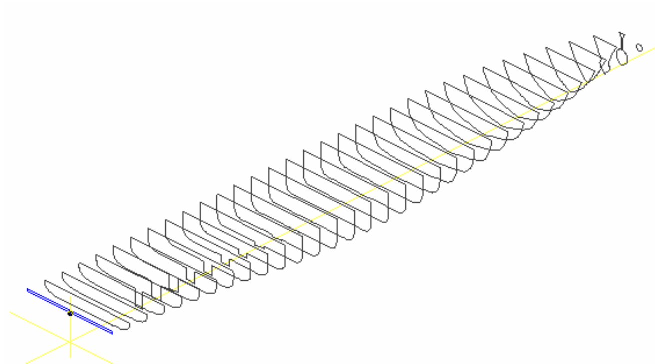


Figure 10 - Hull Sections

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.

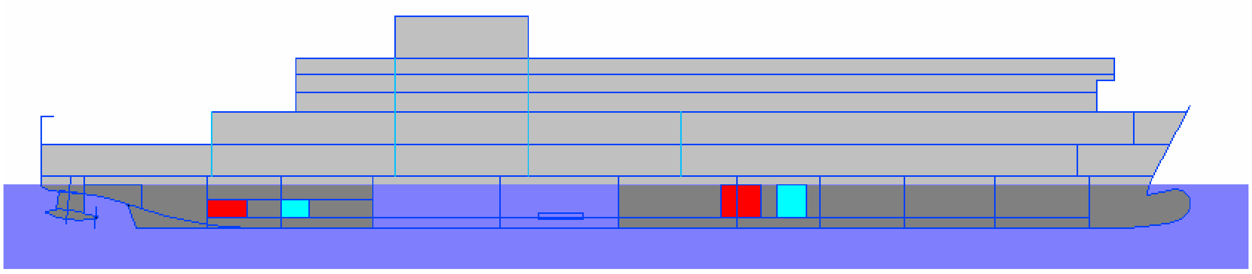


Figure 11 – Worst Case Damage

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 Strategic Model, Option 6. The end result was a reduction in service speed to 22knots. This change reduced the power demand by 14.5%.

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.

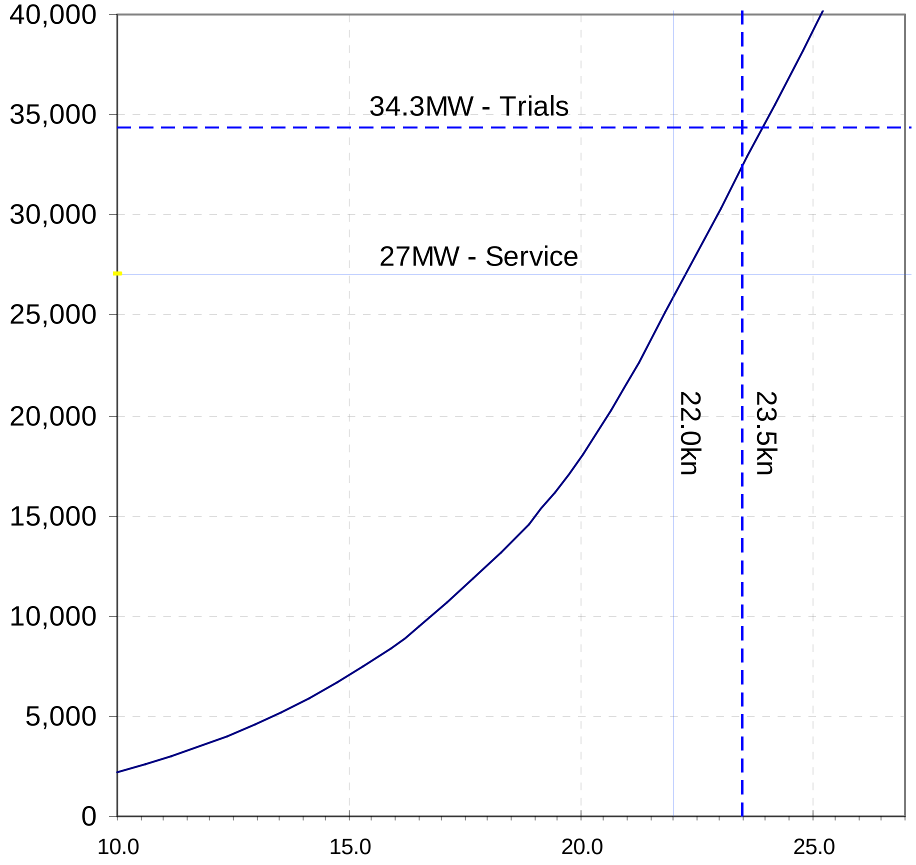


Figure 12 - Speed Power Curve

The curve in Figure 12 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

Oceanic was tasked by Marine Atlantic to estimate the wind and current loads on the vessel when docking.

As noted in section 3.3, based on information provided by Marine Atlantic, Fleetway has determined that a significant increase over the manoeuvring power available on the *Caribou* & *Smallwood* will be required to safely dock a vessel of this size.

Fleetway has selected three (3) bow thrusters of similar size as the bow thrusters fitted on the Caribou along with twin azimuthing, electric, podded propulsors aft.

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 casing and through stairs at the forward end of the vehicle decks. Special-needs passengers can access elevators located at the forward end of the casing. These elevators can be designed to service each level of the ship from tank top to bridge deck. 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 13% more deck space is available for lounges, snack bars, video theatres and dining rooms than is currently provided on the *Smallwood*. In total, N2 has 3,150m^2 of deck space available.

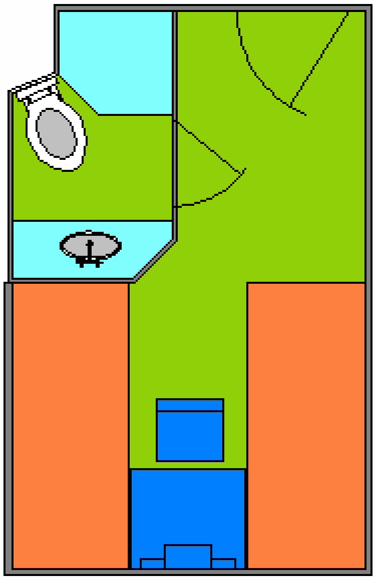
4.5.c Galley

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 560m^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 N2 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

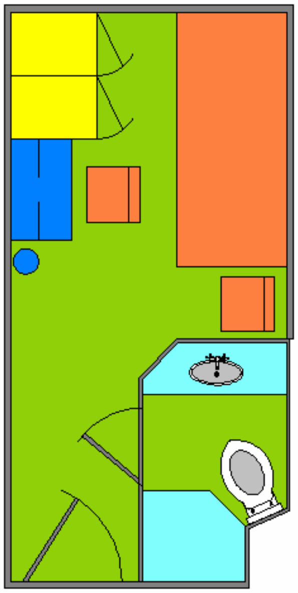
Space for crew lounges, dining areas and change rooms has been increased above that provided on the *Caribou* and *Smallwood*. Space for lounges and change rooms has been allocated on the upper two decks, aft. Each deck has 550m^2 available (1,110m^2 in total) as compared to the 510m^2 available on the *Smallwood*. It is anticipated that the lower deck could provide change/locker rooms along with an activity room and the dining room while the upper deck could provide TV lounges, reading areas, etc. as desired by MAI.

4.6.b Cabins

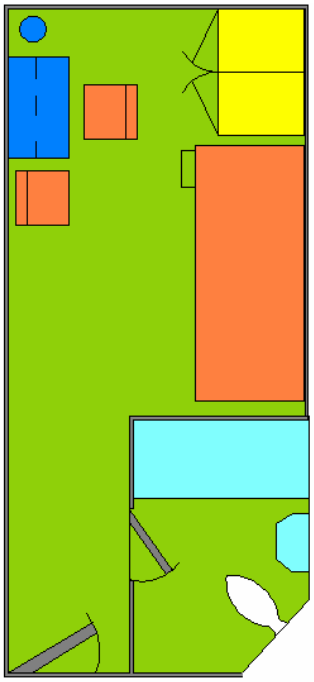
The crew cabin area has been assigned using a more compact cabin arrangement. It is anticipated that the crew could be accommodated in single cabins should Marine Atlantic find this advantageous.

	Smallwood	N2
Crew	77	77
Crew cabins	41	77
Area of Cabin	11.3 m^2	9.0 m^2
Area	786 m^2	1,146 m^2

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



Re-Arranged



Existing (Smallwood)

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	**N2**
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

It is anticipated that the vessel as shown will reflect an estimated purchase price of $263M, including a $5M allowance for hoistable decks. The high cost is due, primarily, to costs associated with the podded, diesel electric propulsion system and the system redundancies required to improve availability in a three vessel fleet.

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 N2 meets or exceeds the requirements as set out in the Consolidated Statement of Work (ref.2) with sufficient capacity to meet demand to 2030 with three (3) N2 vessels in the fleet.

		Requirement	N2
1.	Vessel vehicle capacity	As required to meet peak demand to 2030	3,224 LnM+1,407 LnM on Hoistable Decks
2.	Vessel displacement and stability	SOLAS90	Pass
3.	Speed/Power	22kn	22kn
4.	Manoeuvrability	Safely dock in PAB	Pass
5.	Passenger amenities spaces	5,705m^2	6,119m^2
6.	Crew spaces	2,630m^2	3,621m^2
7.	Tankage		Water - nightly Fuel - after 6 NS/PAB sailings

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 2, 10 Aug 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

Appendix A

Outline Specification for 200m 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................200.000m
Breadth ....29.600m (Estimate)
DEPTH (1dk) .....9.000m (Estimate)
draft....................6.500m (Design)

Disp (SW) ....22,100t (Estimate)
DWT...................5,400t (Estimate)

PAX.............1,000
LnM.............3,224m + 1,407m on hoistable decks (total of 4,631m 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

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 diesel electric utilizing twin, azimuthing, podded propulsion units aft. The main generating requirements shall be met by multiple units distributed in at least two separate watertight compartments. Harbour and/or emergency generators shall be located in accordance with the applicable regulations.

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 Each azimuthing, podded propulsion unit shall be capable of providing thrust through 360° during manoeuvring/docking.

2.4.2 The minimum blade tip clearance shall be 750mm.

2.5 Side Thrusters

Three 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).

3.0 Electrical

3.1 General

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

3.2 Harbour Services

A harbour generator shall be fitted to provide hotel services when along-side.

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.

155 -200 Chain Lake Drive
Halifax, NS B3S 1B3
Tel (902) 494-5700
Fax (902) 494-5792

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.

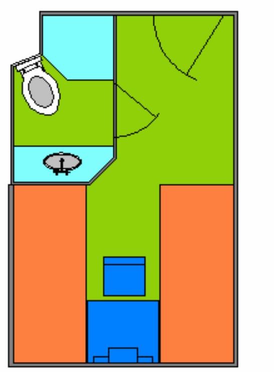
6.2 Passenger Spaces

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 3,000m. 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 : 650m^3
8.1.2 Fresh Water : 450m^3
8.1.3 Water Ballast : 1,600m^3

155 -200 Chain Lake Drive
Halifax, NS B3S 1B3
Tel (902) 494-5700
Fax (902) 494-5792