Marine Atlantic

Fleet Model - Summary

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Introduction

The data presented in this report is intended to summarize the various fleet renewal options that have been investigated as requested by Marine Atlantic and to review the option that :

1) Meets the projected demand
2) Has the least projected life cycle cost.

Two primary tools have been developed to accomplish this:

The **Strategic Fleet Model** is an analytical tool used to develop relative comparisons of various fleet configuration scenarios (options). Each option is defined within the model and the model calculates revenue and expenses based on the relationships between the parameters entered. The calculated data is presented in a financial summary for each option, for each ship for each year for each route (NS-PAB & NS-ARG) and each season (summer/winter). To further evaluate the relative merits of each scenario, a scoring system is used to evaluate the data. This methodology has been used in the past to assess the relative merits of the 10 different fleet configurations in order to short-list the options currently being reviewed.

The **Interim Tactical Model** has been developed to assess the ability of any specific fleet configuration to operate on a pre-set schedule and meet the Peak Traffic (July-Aug) demand. The vehicle decks for each vessel in each option are defined within the model. The model creates loading plans for each sailing for each day. The calculated data is presented as utilization rates and % of traffic left behind for each option for the NS-PAB route over a 3 week period in the summer. Each option is further evaluated by removing one vessel from service and noting how well the fleet configuration is able to meet the total demand.

It should be made clear that the cost data returned by the strategic model is general in nature and is intended to be used to assess the relative merit of various far-reaching decisions rather than to predict accurately what MAI's cash flow will be at some future date. The assessment of relative merit is made possible by using a consistent set of technically sound rules that apply identical values for inflation, fuel prices, insurance, fares, etc. for each option. In this way, the relative differences between options can be maintained at or less than ±10% while any absolute annual value may vary by ±30% or more.

A Time Domain Discrete Event or Tactical Model is being prepared to address the enormous number of variables inherent in a robust, effective operational plan that is capable of responding to the inter-relationships and variability of traffic, weather, ice and complex mechanical systems.

Background

Marine Atlantic Inc. is a Federal Crown Corporation and as such comes under political and public scrutiny. This has been taken into consideration in the options presented in this report.

Other important factors that must be considered are the essentiality of the service, and the environment in which the fleet has to operate.

In terms of a long-term strategy MAI has focused on moving ahead with plans to reconfigure the entire fleet to meet the expected traffic offering and to provide the level of service demanded by its customers.

The first stage of this reconfiguration has been initiated with the assessment and condition survey of the Caribou and Smallwood. The survey provides technical recommendations for cost effective upgrades. Should the fleet modeling conclude a mid-life refit program is the most advantageous solution for MAI, these vessels would be improved and upgraded to meet upcoming regulatory changes and improve the operation and maintainability of various systems. This would extend the life of these vessels, however, the AEU capacity would remain unchanged. Capacity can only be increased with faster crossings, with shorter turn around times, with the addition of larger vessels having more AEU capacity, or a combination thereof.

MAI instructed Fleetway to review numerous fleet renewal options. **Annex B** summarizes the 117 options formally submitted to MAI for review. The total number of options modelled could easily exceed 200. The different options evaluated dealt with refit vs. new-build, charter vs. purchase, 3 vessel vs. 4 vessel fleets, RORO vs. ROPAX vessels and High Speed Craft (HSC) vs. conventional ferries. A number of options investigated the cost delta of introducing vessels sooner vs. later, incrementally vs. as quickly as possible. Other options looked at the cost impact of using particular vessels on particular routes.

Many options failed to adequately meet demand. Other options had significantly worse comparative costs than others. Some options had merit from a cost point of view but also carried a large amount of inherent operational risk.

Ultimately, MAI selected a particular set of fleet characteristics as being preferred due to their consistently lower life cycle costs (LCC) and low risk.

These are:

1) new vessels (vs. refitting existing tonnage)
2) conventional vessels (vs. High-Speed ferries)
3) commonality between all vessels (all ROPAX)
4) a 4 vessel fleet

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Summary

New Vessels *(vs. refitting existing tonnage)*

Refitting existing tonnage is a well-used approach to address the aging of a given fleet. The intent is to minimize capital expenditures (CAPX) and operational costs (OPEX) by repairing or replacing obsolete or worn-out systems with new components and therefore make full-use of the latent value of an asset's structural and other principal systems. This is a particularly efficient approach when there is either a significant reserve of carrying capacity in the existing tonnage or demand increases very little as refitting usually has no positive impact on capacity.

Maintaining compliance with new regulations is a particularly difficult problem at times. By way of example, European ferry owners are currently faced with making vessels designed to SOLAS74 compliant with SOLAS90 and SOLAS90 +50 by adding structural blisters, "duck-tails" and/or flood control doors. Along with the inherent costs associated with implementing these changes they can also adversely affect, speed, fuel economy and/or capacity driving up operational costs.

Providing an adequate budget for an extensive refit is always a risky proposition. It is difficult to assess the condition of complex distributed systems in existing vessels that are in service. This makes accurately specifying a scope of work difficult, inevitably resulting in fairly significant "arisings" during typical mid-life refits of commercial and military vessels alike. There is no need to detail the tribulations faced by owner and builder alike during major refits such as the "Louis St. Laurent". This is not to say extensive refits have all been troubled by delays and unexpected costs. Nonetheless, the risk of some unexpected, significant problem arising is significantly higher in a major refit than it is in a smaller repair and an order of magnitude higher than in a new-build program. Ultimately the decision to refit must consider the risks associated with regulatory compliance, vessel condition unknowns and capacity limits as weighed against fiscal benefits (CAPX and OPEX) that may or may not exist through the remaining life of the vessel including all associated costs.

Given the estimated time required to conduct a full refit on two vessels, it is anticipated that a charter vessel will need to be brought in for two years to provide extra capacity. This vessel will need to be modified to suit the terminals (or vice versa) and brought into compliance with Canadian regulations. For the purposes of this study, it has been assumed that the cost of this will be covered by the annual charter fee. Should a shipyard be capable of completing the refit during MAI's winter season, it may be possible to operate the Atlantic Freighter and Leif Ericson instead of bringing in a charter vessel.

"Option A" (See scorecard) was investigated to see if the reduced CAPX of refitting against new-building could offset the higher maintenance and operating costs associated with older vessels.

The options studied to date indicate that this is not the case as all options using new tonnage were less costly over time than comparable options involving refitting the Caribou and Smallwood.

Conventional vs. High Speed Ferries

In order to assess the potential of meeting demand with smaller vessels operating at higher transit speeds to achieve more cycles per day, numerous High Speed Craft (HSC) options were investigated. These included an option using the Max Mols (or a more current variant), a 29 knot monohull ROPAX and a slender stabilized monohull (Trimaran).

It is Fleetway's opinion that HSC occupy a specialized market niche providing a specific type of service where a significant customer base is willing to pay a premium for reduced transit times. The reduced transit time may open market opportunities for time critical traffic or attract clientele that would otherwise find a faster carrier to suit their schedule requirements. These customers will need to pay a premium to make up the difference between the operational costs of a slower, conventional ferry and a high-speed service as there is no evidence to suggest an HSC can carry the same traffic as a conventional ferry at an equal or lower cost.

Fleetway note that the strategic model is not ideally suited to investigate HSC as the HSC costs are driven by somewhat different factors than conventional ferries and the amount of hard data that can be used to baseline the model is limited.

HSC are by nature extremely lightweight vehicles. This is necessitated by the relationship of weight, speed and propulsion power. Consequently, aluminum (as opposed to steel) is often used as a construction material, engines are lighter and usually much more powerful than on a conventional ferry. Internal fittings are selected for light weight. Most importantly, the traffic mix is usually weight limited (i.e.: there is usually a limit on the number of commercial vehicles that can be carried). This adversely affects longevity and maintenance costs.

Regulatory bodies view HSC as unique and have promulgated regulations specific to the type. The regulations address the risks associated with operating a vessel at twice the speed of conventional vessels and the passenger safety issues arising from the unique geometries, structural designs and interior arrangements. This may affect crewing and maintenance costs.

Ride quality is difficult to achieve and usually requires the use of active ride control devices such as a T-foil forward, two anti-roll fin stabilisers at about two-thirds of the length aft and two interceptors at the transom. These are all devices that protrude from the hull and predictably are subject to damage from docking and/or debris in the water. This may affect the number of cancelled sailings due to weather delays and mechanical problems.

Fleetway has endeavoured to address these issues using the limited available data.

After numerous studies it was clear that the only HSC that exhibited any merit was the Trimaran operating at its maximum deadweight exclusively over the summer months. The LCC (Life Cycle Cost) was comparable to that of a fleet comprised of four identical ROPAX vessels. Fleetway is not confident that the risks associated with introducing a HSC into the MAI operations has been adequately addressed to consider it a viable option.

Commonality Between All Vessels

Fleetway investigated numerous fleet configurations to address this. In each case the vessels were sized to provide the same level of service over the same period of time. In simple terms, each vessel in each fleet configuration was sized to carry the prerequisite number of passengers and traffic each year and no more.

The options analyzed covered:

- 3xROPAX + 1xRORO (similar to the current fleet make-up)
- 3xROPAX + 1xROPAX configured for primarily commercial traffic
- 3xROPAX
- 4xROPAX

From an operational point of view, a multiplicity of identical vessels provides the greatest flexibility and the greatest remaining capacity when faced with the loss of service of any single vessel.

- Any vessel can be assigned to any route allowing the operator the freedom to evenly utilize the vessels and to schedule maintenance on a uniform schedule.

- The total fleet capacity is affected less by the loss of any single asset (through mechanical problems for example) as the number of assets goes up.

- The sailing schedule becomes more regular and simpler to devise as every vessel has identical capacity and speed.

- Crew training is simplified, as they only need to learn how to operate and maintain one ship.

Ultimately a fleet made up of identical sized ROPAX provided the lower Life Cycle Cost (LCC) and the greatest schedule flexibility over any option using a RORO vessel.

3 Vessel Fleet vs. 4 Vessel Fleet

The level of service (sailings per day) expected by both the private and commercial passengers negates the option of a single, very large vessel. Given the terminal congestion issues currently faced by MAI while operating 4 vessels, it is unlikely that it would be possible to operate 6 or more vessels without significant, costly upgrades to the terminals. This would then suggest the ideal fleet size would be between 2 and 5 identical vessels.

The enormous variation in traffic demand between summer and winter (winter traffic volume is approx 53% of summer traffic volume) means that the operator is either faced with a significant under-capacity in the summer or a significant redundancy in the fleet over the winter. Ideally, the variation in demand will be met by operating fewer assets in the winter than in the summer. By “cold-storing” part of the fleet over the winter season, crew, fuel, and maintenance costs can be reduced. This then suggests that the ideal capacity of the winter fleet is the minimum necessary to provide the required service through the winter months with additional numbers added in the summer to meet the increased demand.

MAI has found that two vessels are required through the winter to provide the current level of service. Currently the Caribou and Smallwood easily handle all of the traffic offered using an undemanding schedule. Should demand increase sharply due to holiday traffic or some other event, the scheduled number of sailings of the operational vessels can be increased. If an operational vessel is rendered non-functioning for some reason, the Leif can quickly be taken out of “cold-storage” and brought into service to cover. The present winter fleet would appear to be efficient and equipped with adequate redundancy to provide a robust service. Two vessels, sized to carry the predicted winter demand can then be selected as being the most advantageous configuration to match the current, expected winter service.

Given the difference in traffic volume (winter ≈ 50% of summer), logically, twice the number of these standard assets will be required in the summer than in the winter.

Following the reasoning to its ultimate conclusion, the most favourable fleet make-up would be comprised of four identical vessels.

Preliminary investigations indicated a vessel larger than the Leif Ericsson yet smaller than the Caribou would meet the demand to 2020. MAI realized that this vessel may exhibit some of the undesirable seakeeping characteristic of the Leif Ericsson and suggested a larger vessel, approximately the same size as the Caribou would be a better candidate. Further investigation indicated that a 175m ROPAX would be required to meet demand through the life of the first of class (approximately 2030 assuming a 25 year lifespan). This vessel is slightly shorter than the Caribou but expected to carry more traffic and deadweight due to advances in the field of Naval Architecture since the Caribou was designed.

Fleetway were instructed to also investigate the potential savings afforded by operating a smaller number of larger vessels.

In order to meet peak demand, the smallest ROPAX required in a 3 vessel fleet is 200m Length Overall (LOA). Marine Atlantic raised a concern that a the Caribou / Smallwood (179m LOA) may be the largest vessel that could be safely docked in Port aux Basques (PAB) considering the winds that could be expected. Oceanic was engaged to simulate the manoeuvring characteristics of a 200m ROPAX as defined by Fleetway and to then simulate the docking of the vessel. The PAB approaches, harbour & terminal were modelled and the simulation was baselined using engine/rudder/thrusters orders from the Caribou. Three different vessel control/propulsor options were investigated : conventional rudders with CPP, Becker rudders with CPP and azimuthing podded Propulsors . Each option was fitted with bow thrusters. The CPP options were also fitted with stern thrusters. Oceanic's investigation showed that in 40 knots of wind (MAIs current operational limit) :

1) conventional rudders and CPP would not be able to control the vessel
2) Becker rudders would provide adequate control over the vessel with a small margin
3) Podded Propulsors were very capable of controlling the vessel

Based on the potential for damaging the flaps and linkages on the Becker rudders when backing in ice, this option was deemed operationally unacceptable leaving podded Propulsors as the only control/propulsion option for such a large ferry.

Oceanic's investigation provides evidence that it is possible to dock a 200m vessel provided it is fitted with twin azimuthing, podded Propulsors and bow thrusters.

Ultimately, the cost delta between a fleet made up of 4x175m ROPAX and one made up of 3x200m ROPAX slightly favoured the 4 vessel fleet. This, in conjunction with the greater flexibility and lower operational risk (losing one of three vessels during peak demand periods and manoeuvring in PAB), indicated that the 4 vessel fleet would be preferred over a 3 vessel fleet.

Quantitative Summary (Scorecard)

All data is monetized to allow a subjective comparison between various options. The cumulative costs associated with Capital Expenditures and Operations are divided by the number of years from 2004 to provide an "Average Cost per Annum" that can be used as a subjective score. (This scoring system does not address operational risks, etc.)

Description of Each Column in the Scorecard

CUMM CapX: Reflects cumulative capital expenditures. Options assume all vessel purchase and refit costs, as well a charter fees, to be capital expenditures. Sales reflect monies from the sale of existing vessels. Net capital expenditures are the difference between purchases and sales.

Cumulative Oper Cost: Reflects cumulative operating costs from 2004 up to the noted year.

Cumm Cost: Cumulative cost is the sum of net capital expenditures and cumulative operating costs.

Average Annual Total Cost: Is the cumulative cost divided by the number of years for the option, starting from 2004.

Quantitative Summary

2008

Option	Cumm CapX Note 2: Buy or Charter	Sales	Net CAPX	Cumulative Oper Cost	Cumm Cost	Average Annual Total Cost
A	$0	$0	$0	$379	$379	$95
B	$0	$0	$0	$379	$379	$95
C	$0	$0	$0	$379	$379	$95
D	$0	$0	$0	$379	$379	$95
C1	$9	$(2)	$7	$372	$379	$95
C2	$33	$(2)	$31	$386	$417	$104

2013

Option	Cumm CapX Note 2: Buy/Charter	Sales	Net CAPX	Cumulative Oper Cost	Cumm Cost	Average Annual Total Cost
A	$372	$(2)	$370	$853	$1,223	$136
B	$581	$(62)	$519	$807	$1,326	$147
C	$613	$(62)	$551	$825	$1,376	$153
D	$673	$(62)	$611	$796	$1,407	$156
C1	$644	$(62)	$582	$784	$1,366	$152
C2	$707	$(62)	$645	$823	$1,468	$163

2018

Option	Cumm CapX (Note 2): Buy/Charter	Sales	Net CAPX	Cumulative Oper Cost	Cumm Cost	Average Annual Total Cost
A	$592	$(27)	$565	$1,425	$1,990	$142
B	$895	$(87)	$808	$1,322	$2,130	$152
C	$833	$(87)	$746	$1,370	$2,116	$151
D	$987	$(87)	$900	$1,333	$2,233	$159
C1	$864	$(87)	$777	$1,322	$2,099	$150
C2	$927	$(87)	$840	$1,360	$2,201	$157

2020

Option	Cumm CapX (Note 2): Buy/Charter	Sales	Net CAPX	Cumulative Oper Cost	Cumm Cost	Average Annual Total Cost
A	$840	$(72)	$768	$1,682	$2,450	$153
B	$895	$(87)	$808	$1,569	$2,377	$149
C	$833	$(87)	$746	$1,628	$2,374	$148
D	$987	$(87)	$900	$1,590	$2,490	$156
C1	$864	$(87)	$777	$1,578	$2,355	$147
C2	$927	$(87)	$840	$1,616	$2,456	$154

2025

Option	Cumm CapX Note 2: Buy or Charter	Sales	Net CAPX	Cumulative Oper Cost	Cumm Cost	Average Annual Total Cost
A	$1,108	$(118)	$991	$2,388	$3,379	$161
B	$895	$(87)	$808	$2,306	$3,114	$148
C	$833	$(87)	$746	$2,393	$3,139	$149
D	$987	$(87)	$900	$2,355	$3,255	$155
C1	$864	$(87)	$777	$2,335	$3,112	$148
C2	$927	$(87)	$840	$2,374	$3,214	$153

2030

Option	Cumm CapX Note 2: Buy/Charter	Sales	Net CAPX	Cumulative Oper Cost	Cumm Cost	Average Annual Total Cost
A	$1,108	$(118)	$991	$3,261	$4,252	$164
B	$895	$(87)	$808	$3,233	$4,041	$155
C	$833	$(87)	$746	$3,363	$4,109	$158
D	$987	$(87)	$900	$3,315	$4,215	$162
C1	$864	$(87)	$777	$3,297	$4,074	$157
C2	$927	$(87)	$840	$3,335	$4,176	$161

Option A - Refit Caribou & Smallwood and buy 2 new 175m ROPAX
Option B - Replace Existing Fleet with 3 x 200m ROPAX
Option C - Replace Existing Fleet with 4 x 175m ROPAX
Option D - Replace Existing Fleet with 1 x 157m RORO and 3 x 195m ROPAX
Option C1 - Replace Existing Fleet with 4 New 175m ROPAX (1st new vessel in 2009) - Retire Freighter 2007 & Charter RORO 2007 until 2nd New Vessel Arrives in 2010
Option C2 - Replace Existing Fleet with 4 New 175m ROPAX (1st new vessel in 2009) - Retire Freighter 2007 & Charter ROPAX 2007 until 2nd New Vessel Arrives in 2010

Conclusions

Strategic modeling and the ensuing analysis provides more than a monetized comparison of fleet renewal options. The process of building the model required Marine Atlantic to bring to light a large amount of historical data that contained the essence of the model results and ultimately these conclusions. The modeling exercise was in fact the vehicle for gathering, culling and analyzing the copious amount of data Marine Atlantic had already accumulated. The information provided by assessing the historical data provided some insight into the issues surrounding the existing fleet. Fleetway is confident that the data provided can assist Marine Atlantic in determining the future of the fleet.

The analysis completed to date indicates that a fleet comprised of 4 identical ROPAX vessels will meet the projected traffic demand and will have the lowest comparative Life Cycle Costs to 2030 with the least operational risk.

Ultimately, Marine Atlantic will need to replace every vessel in their fleet.
This is an indisputable fact.

The only real questions are when and with what.

Concepts Tested

Revenue vs. Operational Costs: The analysis is interesting in that revenue does not vary annually between options as long as demand is met. When this is juxtaposed with MAI's primary mandate which is to meet the demand, it is obvious that revenue is fixed and all discussion must focus on cost reduction.

Refit vs. New Build Options : The option to refit the Caribou and Smallwood was adopted as a benchmark to test the merit of all other options. The reduced CAPX of refit vs. new-build could not offset the ever-increasing operating costs of the older vessels vs. the new ones. The message is a strong one – Marine Atlantic must acquire new tonnage to meet demand and must retire existing tonnage to reduce expenses.

Charter vs. Buy Options : Earlier studies explored the benefits of a charter over purchase for a new ROPAX. The charter option has short-term advantages to MAI in that capacity can be increased without incurring a large debt load. This would suggest that there is a potential benefit in pursuing a charter over a short term. This must be weighed carefully against the inherent risks. There was no noticeable cost benefit associated with chartering over purchasing a vessel.

Fleet Size : Fleet sizes from 3 to 5 vessels were investigated at various times. A fleet of over 4 vessels was found to be more expensive to operate and was considered an operational risk as the MAI infrastructure (link-spans, terminals, lay-up docks, maintenance docks, etc.) is not presently set up to manage the larger number of crews and vessels. The maximum sized vessel that can be safely docked in PAB is reached with a three vessel fleet. The optimum was found to be 4 vessels if all identical ROPAX.

RORO / ROPAX : RORO vessels are cheaper to buy and operate than ROPAX vessels. Intuitively, incorporating one into the fleet seemed like it would have some economic benefits. The inability of RORO vessels to carry any PRV or PAX traffic increased the demand and subsequently the size of the associated ROPAX vessels eliminating any cost savings associated with the RORO vessel.

High-Speed Craft (HSC) : HSC offset their low carrying capacity by making more trips. The study demonstrated that a trimaran could meet demand over the summer period at a competitive cost. Fleetway must advise caution given the large number of unresolved risk issues associated with the type. The use of HSC is therefore not recommended.

Top Scorers : From this analysis it can be seen that there are significant benefits in retiring existing assets and acquiring identically configured new ones. The benefits can be summarized as : reduced operating costs, flexibility, improved reliability and availability.

The Three Fundamental Observations and their Impact on the Results

The three assumptions were :

1) The nature of the traffic demand requires vessels with high lane-metre to passenger ratios (LnM/PAX). This is due to the level of commercial traffic and the low level of passenger traffic for 50% of the year;

2) Passenger (PAX) traffic increases occur during the period mid-June through mid-September, and

3) As predicted by MAI, commercial tractor trailer (TT) and drop trailer (DT) traffic will increase given the strong economic outlook for Newfoundland and Labrador.

Their impact is as follows :

Nature of Traffic – The make-up of the traffic demand requires large vessels capable of carrying significant cargo deadweight with relatively small passenger requirements compared to vessels in similar European services. This makes the purchase and/or charter of existing tonnage a difficult proposition as suitable vessels are in very short supply. The speed and turn-around time of the fleet is also critical due to the limited terminal capacity and the volume of vehicle traffic that needs to be processed.

PAX Traffic Seasonal Variation – The high PAX/AEU traffic demand in the summer months (with additional peaks at each weekend) makes it difficult to efficiently tune the fleet for the demand on an annual basis. A fleet with a larger number of small vessels can capitalize on putting more vessels in “cold storage” than a fleet with a small number of large vessels.

Traffic Growth Trends – The predicted growth in traffic demand coupled with MAI’s primary mandate to carry all the traffic that arrives at the terminals makes any Status Quo option untenable. MAI must either increase the number of vessels in their fleet or improve the overall fleet capacity. Other options fail on too many criteria to be considered viable alternatives.

Recommendations

Marine Atlantic will need to develop corporate strategies similar to successful European operators such as DFDS in Denmark whose target fleet age is between 10 and 20 years depending on the service (http://www.dfdsseaways.co.uk/DFDSGROUP/EN/Presentation/BusinessStrategy/). The financial rational for such a strategy can be seen by studying the Marine Atlantic's Strategic Model results, the proof of its validity is in the success of companies like DFDS.

The timing associated with retiring existing tonnage and introducing new tonnage is critical to the success of any fleet replacement strategy. The principle problem lies with the fact that the existing fleet is at or near maximum capacity. This leaves very little slack time before MAI are no longer able to meet their primary mandate of carrying the traffic.

Glossary

AEU	**A**utomotive **E**quivalent **U**nit. This is a method of relating the carrying capacity of cargo deck space to standardized vehicles. Typically 5.34m long by 2.5m wide. It is important to recognize that the AEU is a theoretical unit based loosely on a Volkswagen Golf. The AEU accounts for the fact that passenger vehicles (PRV's) can be stowed closer together than commercial vehicles (CRV's) as they are narrower. Deck markings and Standard Operating Procedures (SOP's) need to reflect this in order to truly capitalize on the higher stowage rate as commercial vehicles require a minimum 3.0m of lane width.
AF	M.V. **A**tlantic **F**reighter
ARG	**Arg**entia, Newfoundland
CAR	M.V. **Car**ibou
CRV	Commercial Vehicle
DT	**D**rop **T**railer. The trailer portion is dropped off at the departure terminal. The carrier (Marine Atlantic) moves the DT onto the vessel using Yarding Tractors; small very manoeuvrable trucks fitted with hydraulic fifth wheels. Upon arrival other Yarding Tractors unload the vessel to the marshalling yard where they await pick-up. Typically 15.24 m. long.
DWT	**D**eadweigh**t**. Displacement - Lightship = Deadweight The portion of the vessels total weight (Displacement) that is made up of everything not part of the vessel itself (Lightship). This includes all the liquid in the tanks, vehicles, passengers, crew, provisions, spares, etc.
FMEA	**F**ailure **M**odes and **E**ffects **A**nalysis. An analytical process used extensively in other transportation industries, the offshore industry and the military. The process involves tracking the effects of a point failure through a particular system to determine any critical failure points.
kW	Kilowatt. One thousand watts. Metric unit of measure for power. BHP x 0.746 = kW
Link-Span	The shore ramps that link the vehicle decks with the terminal. The ramps are adjustable to account for changes in tide and vessel draft.
LnM	**L**a**n**e **M**etres. Unit of measure for vehicle decks. Lane-metres are always measured on standard 2.50 m. lane widths.
LE	M.V. **L**eif **E**ricson
LOA	**L**ength **O**ver **A**ll. Refers to the maximum length of a vessel in its normal operating

configuration.

MAI **M**arine **A**tlantic **I**ncorporated

NS **N**orth **S**ydney, Nova Scotia

PAB **P**ort **A**ux **B**asques, Newfoundland

PAX Passenger(s). Used across travel industry, origin unknown.

PRV Passenger Vehicle

PWP **Pl**anned **W**ork **P**eriod. Vessels are removed from service during periods of reduced demand to facilitate maintenance and repair. This differs from refits in terms of the scope of the work carried out and the time frame of the work.

RAM **R**eliability, **A**vailability**, M**aintainability. The basic concepts used to describe the ability of a system or vessel to meet its design objectives through its service life.

ROPAX **R**oll **O**n **PAX**. This acronym is used for commercial vessels that load cargo over stern and/or bow ramps. They carry a large number of passengers, usually based on the number of AEU's the vessel can carry plus an allowance for walk-on traffic. The vessels range from day ferries with no dining facilities or overnight accommodations to cruise ferries that have a full complement of services.

RORO **R**oll **O**n **R**oll **O**ff. This acronym is used for commercial vessels that load cargo over stern ramps. Traffic is backed on and driven off. They are limited to a maximum of 12 passengers by Transport Canada. Higher loading/discharge efficiency can be achieved by using bow and stern ramps which allows the traffic to drive on and drive off. Occasionally referred to as a PCTC : Pure Car Truck Carrier or PCC : Pure Car Carrier if the load type is specialized.

SML M.V. Joseph & Clara Smallwood

SOP **S**tandard **O**perating **P**rocedure. The rules that govern the operational aspects of everything from ticketing to emergency procedures. The SOP's contain the decision matrix for efficiently and safely operating the fleet in a consistent manner.

TT **T**ractor **T**railers. Highway semi-trailer units. They can be up to 24.4m long and require 3.00 m. of lane width. Typically 21.24m. long.

ANNEX A

A Review of Asset Features

Vessel features found to directly and/or indirectly affect the fiscal performance of the fleet have been noted below for information :

- Capacity to load/unload off of the high and low level link-span (shore ramp) simultaneously
- Internal ramp(s) to facilitate loading the upper vehicle deck in Argentia
- Drive-on Drive-off capability to reduce loading time (i.e.: no backing on ROPAX)
- Sufficient displacement and stability to carry an all commercial vehicle load on both vehicle decks (Caribou & Smallwood are both DWT and Stability limited now)

- Ice strengthening of hull and all appendages
- Good seakeeping qualities (passenger comfort criteria)
- Ability to back into an ice infested terminal without damaging appendages
- Ability to occasionally negotiate heavy 100% ice cover when entering the harbour
- Adequately sized bow/stern thrusters to manoeuvre in Port aux Basques

- Simple, robust, easily maintained systems
- Redundancy in service critical systems (ex: propulsion, thrusters, water, heating, etc)

- Adequate seating for the entire PAX capacity.
- Unadorned dining and snack facilities
- Comfortable and robust seating with additional space for carry-on bags
- Unadorned, yet comfortable passenger cabins
- Video (movie) lounges
- “Rent-a-bunk” facilities
- In service information systems (ex: PA & info screens) that include special needs passengers.

Full regulatory compliance has been assumed as a prerequisite and has not been further addressed in this list.

ANNEX B

Summary Listing of Primary Options Investigated

No.	Date	Option	Option Description
1	Nov-04	1A	Operate the Existing Fleet along with a chartered high speed catamaran in the summer (91m x 990 LnM ROPAX - Max Mols)
2	Nov-04	1B	Charter a ROPAX in the Summer starting in 2008 when Caribou begins its refit (150m x 1423 LnM ROPAX)
3	Nov-04	1C	Operate the Existing Fleet along with a chartered high speed monohull in the summer (194m x 1852 LnM ROPAX)
4	Nov-04	2	Operate Existing Fleet, Retire Freighter & Smallwood in 2007, Buy New ROPAX in 2007, Retire Leif in 2014 & Buy New RORO in 2014
5	Nov-04	2-1	205m x 3241 LnM ROPAX
6	Nov-04	2-2	175m x 2255 LnM RORO and 200m x 2635 LnM ROPAX
7	Nov-04	2-3	205m x 2752 LnM RORO
8	Nov-04	3A	Purchase a Larger Faster Vessel (RORO or ROPAX) and Sell Freighter (175m x 2255 LnM RORO)
9	Nov-04	3B	Charter a Larger Faster Vessel (RORO or ROPAX) and Sell Freighter (200m x 2635 LnM ROPAX)
10	Nov-04	4	Replace Exisiting Fleet with 3 x 200m x 2530 LnM ROPAX
11	Nov-04	X	Replace Exisiting Fleet with 3 x 176m x 2226 LnM ROPAX
12	Dec-04	Add Com A1	ADD COM A1: Sell Lief Ericson & Atlantic Freighter, Buy New ROPAX (28kn, 2200 L-M)
13	Dec-04	Add Com A2	ADD COM A2: Sell Lief Ericson & Atlantic Freighter, Buy New ROPAX (28kn, 2200 L-M)
14	Dec-04	Add Com B1	ADD COM B1: Sell Lief Ericson & Atlantic Freighter, Buy New ROPAX (28kn, 2200 L-M)
15	Dec-04	Add Com B2	ADD COM B2: Sell Lief Ericson & Atlantic Freighter, Buy New ROPAX (28kn, 2200 L-M)
16	Dec-04	Historical a	OPTION Historical A : Buy Leif Ericson in 2000
17	Dec-04	Historical b	OPTION Historical B : Charter Leif Ericson in 2000
18	Dec-04	1A	OPTION 1a: Staus Quo Plus High Speed Craft (Max Mols)
19	Dec-04	1B	OPTION 1b: Staus Quo Charter ROPAX
20	Dec-04	2	OPT2: Ret AF 2008, CA/SW w/Refit, New 600Pax/3500LnM 2007, Ret LE 2014
21	Dec-04	3A	OPTION 3A : Sell Atlantic Freighter & Buy 1 ROPAX
22	Dec-04	3B	OPTION 3B: Sell Atlantic Freighter and Charter 1 ROPAX
23	Dec-04	4	OPTION 4: Sell AF, CAR & SMLW & Build 2 New ROPAX
24	Dec-04	X	OPTION X: Buy 1 Used RORO & Build 3 New ROPAX (50% Fin)
25	Dec-04	TT-Line A	TTLA:AF Ret 2008, CA/SW w/Refit, LE Ret 2014, STIII US$33k/d
26	Dec-04	TT-Line B	TTLB:AF €10k/d Ret 2008, CA/SW w/Refit, LE Ret 2014, STIII US$33k/d
27	Dec-04	TT-Line C1	TTLC1:AF Ret 2008, CA/SW w/Refit, LE Ret 2014, STIII US$30k/d
28	Dec-04	TT-Line C2	TTLC2:AF Ret 2008, CA/SW w/Refit, LE Ret 2014, STIII US$27k/d
29	Dec-04	TT-Line C3	TTLC3:AF Ret 2008, CA/SW w/Refit, LE Ret 2014, STIII US$24k/d
30	Dec-04	TT-Line D1	TTLD1:AF €12k/d Ret 2008, CA/SW w/Refit, LE Ret 2014, STIII US$33k/d
31	Dec-04	TT-Line D2	TTLD2:AF €8k/d Ret 2008, CA/SW w/Refit, LE Ret 2014, STIII US$33k/d
32	Dec-04	TT-Line D3	TTLD3:AF €6k/d Ret 2008, CA/SW w/Refit, LE Ret 2014, STIII US$33k/d
33	Dec-04	1	OPTION 1: Status Quo and Charter High Speed Craft
34	Dec-04	2	OPTION 2: Staus Quo and Purchase
35	Dec-04	3	OPTION 3: Sell Atlantic Freighter & Buy New ROPAX
36	Dec-04	4	OPTION 4: Retire Freighter in 2007 and Buy New 205m x 2917 LnM ROPAX
37	Dec-04	5	OPTION 5: Retire Freighter in 2008 and Buy New 194m x 1852 LnM ROPAX
38	Dec-04	6	OPTION 6: Retire Freighter in 2008 and Caribou in 2010 and replace with 2 x New 205m x 3025 LnM ROPAX
39	Dec-04	7	OPTION 7: Replace Existing Fleet with 3 x New 187m x 2464 LnM ROPAX

No.	Date	Option	Option Description
40	Jan-05	1	OPTION 1: Status Quo and Charter HSC for the Summer
41	Jan-05	2	OPTION 2: Status Quo and Charter a New ROPAX for the Summer
42	Jan-05	3	OPTION 3: Sell AF(2008) & LE(2014) & Buy 2 New ROPAX
43	Jan-05	4	OPTION 4: Sell the Atlantic Freighter and Charter a New ROPAX
44	Jan-05	5	OPTION 3: Sell AF(2008) & LE(2009) & Buy 2 New ROPAX
45	Jan-05	6	OPTION 6: Sell AF(2008) CA(2010) SW(2012) & LE(2014) & Buy 3 New ROPAX
46	Jan-05	7	OPTION 7: Replace the Fleet with 1 Used RORO and 3 New ROPAX
47	Jan-05	1	OPTION 1: Status Quo and Charter High Speed Craft for the Summer
48	Jan-05	2	OPTION 2: Status Quo and Charter ROPAX for the Summer
49	Jan-05	3	OPTION 3: Sell Atlantic Freighter and Purchase 1 + 1 New ROPAX
50	Jan-05	4	OPTION 4: Sell the Atlantic Freighter / Charter 1 New ROPAX / Buy 1 New ROPAX
51	Jan-05	5	OPTION 5: Sell Atlantic Freighter & Leif Ericson and Buy New Fast ROPAX
52	Jan-05	6	OPTION 6: Sell Caribou, Smallwood & Freighter and Buy 2+1 New ROPAX
53	Jan-05	7	OPTION 7: Replace the Fleet with 1 New RORO and 3 New ROPAX
54	Jan-05	8	OPTION 8: Sell Atlantic Freighter & Leif Ericson and Buy New RORO
55	Jan-05	9	OPTION 9: Replace the Fleet with New ROPAX (3 + 1 comm)
56	Jan-05	1	OPTION 1: Status Quo and Charter High Speed Craft for the Summer
57	Jan-05	2	OPTION 2: Status Quo and Charter ROPAX for the Summer
58	Jan-05	3	OPTION 3: Sell Atlantic Freighter and Purchase 1 + 1 New ROPAX
59	Jan-05	4	OPTION 4: Sell the Atlantic Freighter / Charter 1 New ROPAX / Buy 1 New ROPAX
60	Jan-05	5	OPTION 5: Sell Atlantic Freighter & Leif Ericson and Buy New Fast ROPAX
61	Jan-05	6	OPTION 6: Sell Caribou, Smallwood & Freighter and Buy 2+1 New ROPAX
62	Jan-05	7	OPTION 7: Replace the Fleet with 1 New RORO and 3 New ROPAX
63	Jan-05	8	OPTION 8: Sell Atlantic Freighter & Leif Ericson and Buy New RORO
64	Jan-05	9	OPTION 9: Replace the Fleet with New ROPAX (3 + 1 comm)
65	Jan-05	10	OPTION 10: Replace the Fleet with New ROPAX (4)
66	Oct-05	4	Option A - Refit Caribou & Smallwood and buy 2 new 175m ROPAX
67	Oct-05	6	Option B - Replace Existing Fleet with 3 x 200m ROPAX
68	Oct-05	10	Option C - Replace Existing Fleet with 4 x 175m ROPAX
69	Oct-05	4	Option A - Refit Caribou & Smallwood and buy 2 new 175m ROPAX
70	Oct-05	6	Option B - Replace Existing Fleet with 3 x 200m ROPAX
71	Oct-05	10	Option C - Replace Existing Fleet with 4 x 175m ROPAX
72	Oct-05	4	Option A - Refit Caribou & Smallwood and buy 2 new 175m ROPAX
73	Oct-05	6	Option B - Replace Existing Fleet with 3 x 200m ROPAX
74	Oct-05	10	Option C - Replace Existing Fleet with 4 x 175m ROPAX
75	Oct-05	4	Option A - Refit Caribou & Smallwood and buy 2 new 175m ROPAX
76	Oct-05	6	Option B - Replace Existing Fleet with 3 x 200m ROPAX
77	Oct-05	10	Option C - Replace Existing Fleet with 4 x 175m ROPAX
78	Oct-05	4	Option A - Refit Caribou & Smallwood and buy 2 new 175m ROPAX
79	Oct-05	6	Option B - Replace Existing Fleet with 3 x 200m ROPAX
80	Oct-05	10	Option C - Replace Existing Fleet with 4 x 175m ROPAX
81	Oct-05	4	Option A - Refit Caribou & Smallwood and buy 2 new 175m ROPAX
82	Oct-05	6	Option B - Replace Existing Fleet with 3 x 200m ROPAX
83	Oct-05	10	Option C - Replace Existing Fleet with 4 x 175m ROPAX
84	Oct-05	4	Option A - Refit Caribou & Smallwood and buy 2 new 175m ROPAX
85	Oct-05	6	Option B - Replace Existing Fleet with 3 x 200m ROPAX
86	Oct-05	10	Option C - Replace Existing Fleet with 4 x 175m ROPAX
87	Jan-06	4	Option A - Refit Caribou & Smallwood and buy 2 new 175m ROPAX
88	Jan-06	6	Option B - Replace Existing Fleet with 3 x 200m ROPAX
89	Jan-06	10	Option C - Replace Existing Fleet with 4 x 175m ROPAX

No.	Date	Option	Option Description
90	Jan-06	4	Option A - Refit Caribou & Smallwood and buy 2 new 175m ROPAX
91	Jan-06	6	Option B - Replace Existing Fleet with 3 x 200m ROPAX
92	Jan-06	10	Option C - Replace Existing Fleet with 4 x 175m ROPAX
93	Jan-06	7	Option D - Replace Existing Fleet with 1 x 157m RORO, 1 x 180m ROPAX and 2 x 200m ROPAX
94	Feb-06	4	Option A - Refit Caribou & Smallwood and buy 2 new 175m ROPAX
95	Feb-06	6	Option B - Replace Existing Fleet with 3 x 200m ROPAX
96	Feb-06	10	Option C - Replace Existing Fleet with 4 x 175m ROPAX
97	Feb-06	7	Option D - Replace Existing Fleet with 1 x 157m RORO, 1 x 180m ROPAX and 2 x 200m ROPAX
98	Feb-06	7a	Option E - Replace Existing Fleet with 1 x 157m RORO, 1 x 180m ROPAX and 2 x 200m ROPAX – 180m ROPAX is Chartered for 3 years starting in 2009
99	Feb-06	7	Option F - Replace Existing Fleet with 1 x 157m RORO (Charter 3 years starting 2009 then purchase in 2012) , 1 x 180m ROPAX and 2 x 200m ROPAX
100	Feb-06	4	Option A - Refit Caribou & Smallwood and buy 2 new 175m ROPAX
101	Feb-06	6	Option B - Replace Existing Fleet with 3 x 200m ROPAX
102	Feb-06	10	Option C - Replace Existing Fleet with 4 x 175m ROPAX
103	Feb-06	7	Option D - Replace Existing Fleet with 1 x 157m RORO and 3 x 195m ROPAX
104	Feb-06	7a	Option E - Replace Existing Fleet with 4 New 175m ROPAX (1st new vessel in 2010) - Retire Freighter 2007 & Charter RORO 2007 until 1st New Vessel Arrives in 2010
105	Feb-06	7b	Option F - Replace Existing Fleet with 4 New 175m ROPAX (1st new vessel in 2010) - Retire Freighter 2009 & Charter RORO 2007 until 1st New Vessel Arrives in 2010
106	Feb-06	7c	Option G - Replace Existing Fleet with 4 New 175m ROPAX (1st new vessel in 2010) - Retire Freighter 2007 & Charter ROPAX 2007 until 1st New Vessel Arrives in 2010
107	Feb-06	7d	Option H - Replace Existing Fleet with 4 New 175m ROPAX (1st new vessel in 2010) - Retire Freighter 2009 & Charter ROPAX 2007 until 1st New Vessel Arrives in 2010
108	Apr-06	4	Option A- Refit Caribou & Smallwood and buy 2 new 175m ROPAX
109	Apr-06	6	Option B- Replace Existing Fleet with 3 x 200m ROPAX
110	Apr-06	10	Option C- Replace Existing Fleet with 4 x 175m ROPAX
111	Apr-06	7	Option D- Replace Existing Fleet with 1 x 157m RORO and 3 x 195m ROPAX
112	Apr-06	7a	Option C1- Replace Existing Fleet with 4 New 175m ROPAX (1st new vessel in 2009) - Retire Freighter 2007 & Charter RORO 2007 until 2nd New Vessel Arrives in 2010
113	Apr-06	7b	Option C2- Replace Existing Fleet with 4 New 175m ROPAX (1st new vessel in 2009) - Retire Freighter 2007 & Charter ROPAX 2007 until 2nd New Vessel Arrives in 2010
114	Apr-06	7c	Option C3- Replace Existing Fleet with 4 New ROPAX - 1 x 127m Trimaran & 3 x 175m ROPAX (1st new vessel (N1) in 2009) - Retire Freighter 2009 - Trimaran on Drop & Go for NS-PAB Summer Only (Note 1)
115	Apr-06	7d	Option C4- Replace Existing Fleet with 4 New ROPAX - 1 x 127m Trimaran & 3 x 175m ROPAX (1st new vessel (Trimaran) in 2009) - Retire Freighter 2009 - Trimaran on Drop & Go for NS-PAB/ARG + 80% Winter
116	Apr-06	7e	Option C5- Replace Existing Fleet with 3 New 175m ROPAX (1st new vessel in 2009) - Retire Freighter 2007 & Charter ROPAX 2007 until 2030
117	Apr-06	7f	Option C6- Replace Existing Fleet with 4 New ROPAX - 1 x 127m Trimaran & 3 x 200m ROPAX (1st new vessel (Trimaran) in 2009) - Retire Freighter 2009 - Trimaran on Drop & Go for NS-PAB + 80% Winter

ANNEX C

Transition Plan

Existing Fleet – New Fleet

The existing fleet is comprised of four vessels :

- Caribou
- Joseph & Clara Smallwood
- Life Ericsson
- Atlantic Freighter

The new fleet is to be comprised of four vessels:

- 175m ROPAX
- 175m ROPAX
- 175m ROPAX
- 175m ROPAX

The existing assets meet current demand with a small reserve. Additional capacity can be introduced by using management discretionary sailings to increase the number of departures per week. The overall ability of the fleet to meet demand is expected to reach its limit in approximately 2010. Given that the Atlantic Freighter will likely be retired in 2008 a charter vessel will be required at that time to take up the traffic demand normally carried by her. Ideally, the first new vessel will be brought into service prior to the retirement of next vessel (2010).

If we work backward from when the vessel enters service, assuming a design/build contract with a shipyard is used:

- Month 0 : 1st new vessel enters service
- Month -2 : Vessel accepted and enters training & operational work-ups
- Month -3 : Vessel enters trials
- Month -17 : Construction begins
- Month -24 : Production Engineering Begins
- Month -31 : Concept Design Begins
- Month -37 : Funding in place, begin contract negotiations with shipyard
- Month -48 : Set up program management team.

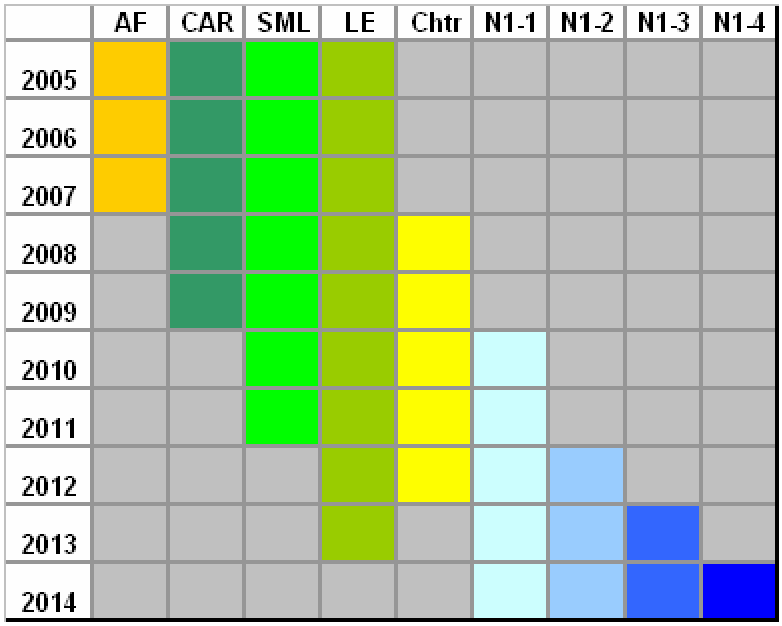
This suggests that in order to introduce the first ship in 2010, MAI need to have the program approved in 2007 and funded in 2008. This will enable MAI to begin negotiations with the selected shipyard. Failure to secure the appropriate approvals on time will mean that the Smallwood and Caribou will need to be operated longer increasing the overall operating costs or; a second charter will need to be secured also increasing the overall operating costs. The Charter must continue until the 2nd new vessel enters service (2011/2012) as the Caribou will be retired and replaced by the 1st New ROPAX in 2010.

Based on a planned lifespan of 25 years, the new class of ferries would provide the necessary fleet capacity until 2035 when the first new ROPAX is sold or retired.

The time line is shown on the next page :

Year	Event	Comments
2004	Planning & Review	*Fleet Renewal Strategic Analysis*
2005	Planning & Review	*Fleet Renewal Tactical Analysis*
2006	Fleet Make-up Selected	*MAI requests project funding*
	Set-up Project Mgt Team	*Prepare performance specification and begin shipyard selection process*
2007	Charter ROPAX Study	*Review and short-list potential vessels for charter*
	Shipyard Shortlist	*Shortlist finalized by MAI, RFQ's issued and reviewed.*
2008	Funding in place	*Program budgets are released*
	Shipyard selected	*Begin negotiations with the selected shipyard*
	Vessel leaves service	*Retire Atlantic Freighter*
	Begin ROPAX charter	*Vessel will probably need some mod's to make it compliant with CDN regulations and to interface with MAI facilities.*
2009	Production	*Concept & Functional design completed, production begins*
2010	Production, Trials & Acceptance	*MAI begin training and operational work-ups in the early part of the year*
	Vessel leaves service	*Retire Caribou*
	1st new ROPAX enters service	
2011		
2012	Vessel leaves service	*Retire Joseph & Clara Smallwood*
	2nd new vessel enters service	
	End ROPAX charter	*Vessel may need to be modified to return it to its original configuration*
2013	**3rd new vessel enters service**	
2014	Vessel leaves service	*Retire Leif Ericson*
	4th new vessel enters service	

The introduction and retirement of vessels can be summarized in a table as shown below:



This clearly demonstrates that the requirement to always have 4 vessels in service has been fulfilled.

Charter RORO vs. Charter ROPAX

RORO vessels are cheaper to acquire and to operate than ROPAX vessels. They are also more numerous which suggests that it should be easier to find a suitable RORO for charter than a ROPAX for charter. Fleetway investigated the ability of a chartered RORO to meet demand to 2012 and the ability of a chartered ROPAX to do the same. The cost delta was assessed using the Strategic Fleet Model.

The Interim Tactical Model runs completed indicated that the Chartered RORO would be able to meet the traffic demand to 2009 and the ROPAX would meet demand through to 2012 without problem.

Options C1 and C2 indicate the cost differential as favouring the RORO by approximately $10M (in 2013) confirming the assumption that a RORO would be cheaper to operate. It is unfortunate that the fleet make up with one does not meet the projected traffic demand.

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