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Feasibility study for the transport of Colombian export flowers onboard the techno-superliner

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FEASIBILITY STUDY FOR THE TRANSPORT OF COLOMBIAN EXPORT FLOWERS ONBOARD THE TECHNO-SUPERLINER

By

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Colombia

A dissertation submitted to the World Maritime University in partial fulfilment of the requirements for the award of degree of

MASTER OF SCIENCE

in

SHIPPING MANAGEMENT

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Declaration

I certify that the material in this dissertation is my own work, all of which is not, has been clearly identify, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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Abstract

Title of Dissertation: Feasibility study for the transport of Colombian flowers onboard the Techno-Superliner

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The dissertation is a feasibility study of the Flower transport from Colombia to the USA, using a newly developed Japanese design high speed craft named as Techno Super-liner.

A description is conducted about the principal features of the Techno Super-liner, its relevant technical background, its concept idea, its historical evolution and the response of the transport industry.

A look is taken on the current Colombian flower market conditions, identifying competitors, analyzing historical development, describing competitive advantages, studding principal consumer markets and stating future trends.

Several hypothetical scenarios are created based on current market prices, establishing the ground floor to analyze forecasted conditions in order to determine the economical, technical and financial feasibility of the project.

The concluding chapter bench marks other similar ventures, states the benefits on using the TSL as a transport solution and explores alternative markets.

KEYWORDS: Techno, Super-liner, flower, fast, speed, craft.

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List of Abbreviations

EU	European Union
H&M	Hull and Machinery
H 40'	High cube 40 feet container
ICHCA	International Cargo Handling Co-ordination Association
IATA	International Air Transport Association
INCOMEX	Colombian Institute of foreign Trade
P&I	Protection and Indemnity
TEU	Twenty Equivalent Units
TSL	Techno-Superliner
TSL-A	Techno-Superliner Air Cushion Type
TSL-F	Techno-Superliner Hydrofoil Type
OPEC	Organisation of the Petroleum Exporting Countries
OSCC	Overseas Shipbuilding Co-operation Centre
SWATH	Small Water Plane Area Twin Hull
R&D	Research and Development
USA	United States of America

Chapter One

Introduction

Transport of cargo and passengers has been throughout the ages a trigger to economic development. A cohesive network linking markets and production areas is extremely important to promote trade and increase productivity. This century has seen the constant development in the modes of transport, trying to ensure the most economical, effective and reliable way to move commodities and people. From the use of the jet engine on the air industry, passing through containerization in the shipping sector and even double stacking procedures in the railways, all these revolutionary ideas have contributed to bring closer together a shrinking world.

With the invention of the airplane and its rapid technological development into the fastest means to move goods to nearly every corner of the planet, traditional oceanic transport became divided. Low capital cost and low value added cargo continued to be transported by traditional sea borne means, but eventually, high value added cargo and passengers switched to constantly more efficient air transportation.

This segmentation toward the air, not only captured elaborated industrial products but also all those that in some way or another were time sensitive. Moreover, during the first stages of the air cargo industry, time sensitive commodities were the exclusive focus of attention, representing an effective alternative to transport the most valuable of all commodities namely information and documents, what then was commonly known as mail. Rapidly, safety in the sky was improved and what was developed as a war machine turned out to be the perfect passenger transport solution.

In addition, based in terms of speed, fare and safety each mode of transport has identified and nested on a particular industry segment, characterized mainly by the relation between freight rates and the cargo value. The cargo value was expressed in terms of time value, cost of capital and value added. Thus, transport companies direct their marketing and commercialization accordingly, trying to enlarge their market share in their reserved niches. They frequently engage themselves in furious competition, occasionally based on product differentiation but most of the time on freight reduction.

In the past 20 years, a shy trend on the Shipping sector is becoming stronger. Starting in the 1970s with the establishment of the hydrofoil services in the English channel, fast sea transport services have been developed as a response to market necessities. Conceived as a pure passenger segment, fast sea transport has experienced progress but has not exploited its full potential. According to Drewry in January the world fleet of fast ferries consists of 1,218 ships able to carry 269,000 passengers and 6,186 cars per year. These figures are still, considerably minute if we take into account the world fleet container ship in the same period to be 17,800 ships with an impressive cargo capacity of 2.8 million Twenty-foot Equivalent Units, TEUs (ISL, 1997).

Because in general terms they are conservative, shipowners and investors are still somehow reluctant to invest heavily in pure freight high speed vessels. Government initiatives by the EU Headquarters and the Ministry of Transport in Japan indicate that the trend for the next century could be focused on cost effective, energy and environmentally friendly fast sea transport, as an alternative to increasingly congested, damaging and polluting road transport.

The above argument plus the shippers demands for an alternative to compete with air transport, has promoted the creativity of some naval architects, who trying to meet existing demands, have developed new high speed craft designs. As pioneers on this segment we clearly can identify InCat Australia with its effective "Wavepierce" design, the Japanese shipping industry's joint effort which materialized in the construction of the "Techno Super-liner" prototypes and recently, the appearance of the monohull design "Fastship", launched by Tronycroft, Giles & Company in the USA.

The development of this new technology opens up a wide spectrum for further application in transport solutions for specific products that could trigger massive high speed craft research and production to replace the already anachronistic short sea shipping fleet.

The transport of flowers is a typical example of a time sensitive perishable product, which obviously falls under the above statement, as a TSL application possibility. The transport of flowers is one of the most profitable and stable air transport domain, and until now, there was no other viable alternative transport solution available. By transporting on airplanes, the markets were provided with fresh, long lasting, wide variety of flowers. Consequently more than 50% of the market value of imported flowers in the US and the EU is assigned to transport cost. As a result, the consumer is paying an extremely high price for a low value added commodity.

The purpose of this dissertation is to carry out a feasibility study to determine the viability for the use of a high speed craft design, to supply the Colombian Flower industry with an alternative competitive sea transport solution for the trade of products between the production area in Bogota to the market place in Miami.

The Japanese design, the Techno-Superliner (TSL), was selected as the suitable sea vehicle to conduct the proposed task. This design was selected considering the high degree of effectiveness of Japanese shipbuilders and the high technological development achieved by the Japanese industry in the last 20 years, plus possible financial concessions that could be negotiated with Japanese yards.

In the second Chapter a complete analysis of the TSL is conducted, based on information provided by the Technological Research Association of Techno-Superliner. The analysis starts with the scientific background supporting the design, also comparing characteristics of different hull forms and describing the focus of attention on technology development. Moreover, it revises the different Research and Development (R&D) steps conducted and the historical evolution of the project, ending with comments from the transport industry and description of possible innovative applications.

The flower industry was selected as the subject of study because it represents a typical example of a low value added and low capital cost product, currently being transported on an extremely costly way due to its time sensitivity. Moreover it represents the second most important not traditional export product in Colombia.

In the third Chapter a complete analysis of the current and past situation of the flower sector in Colombia is conducted. The analysis starts from a description of the production area and the main competitive advantages which exist vis-à-vis other producer competitors, reviewing the constant rise in productivity, analyzing principal market conditions, identifying competitors, analyzing particular trade characteristics by flower type and finishing with an analysis of the traditional transport procedures.

The fourth chapter concentrates on exploring all possible situations for establishing a route using a TSL ship to transport flower from Colombia to the US. All assumptions and projected results are based on current data, and the conclusions are taken after considering the best possible, both technically and economically suitable solution.

Several obstacles were experienced throughout the research and the writing of this dissertation. High Speed Craft in general and the flower sea transport in particular are subjects never combined before.

The literature referring to the TSL prototype's detail technical data is rare, especially since technological developments of this kind are kept as industrial secrets, well protected by patent law. In addition, information about the flower trade in Colombia and its transport procedures is extremely difficult to obtain, since the dangerous and unstable social situation in Colombia demand from managers, maximum reserve on releasing information that could be used for illicit purposes.

In addition, the viability for the utilization of the TSL for the transport of flowers from Colombia to the US was selected as a dissertation topic because this project could provide an alternative means of transport to the expanding Colombian flower industry. Furthermore, it could mean the rebirth of the Colombian shipping industry in a different segment of the transport spectrum. This dissertation also aims to contribute to the promotion of the Japanese new shipbuilding activities, by finding a niche market for the Japanese ship, the TSL. The large scale construction of this specialized transport vehicle could position Japan in the vanguard of high speed and pure freight shipbuilding, as world leader on fast ship transport solutions provider.

The subject was selected also, because to conduct a concise study combining new technology and updated market conditions represented a personal challenge. It gives the author the opportunity to combine the newly acquired knowledge in the World Maritime University (WMU) on shipping management issues with the previous experience on technical matters gained in the Overseas Shipbuilding Cooperation

Centre (OSCC) in Japan and as an engineer officer onboard ships of Colombian national fleet.

The methodology employed to complete this dissertation is focused on personal contacts and e-mail interviews directly with the flower trade participants, port agents and air transport companies, plus the review of existing TSL reports and an extensive collection of data from the internet and high speed craft specialized reports. These individual sources, updated relevant market and technical transport procedures, as well as trade information are gathered and combined to create 15 different hypothetical scenarios and conduct an equal number of cash flow and statement of income calculations. These calculations are displayed on spread sheets and based on which graphics are drawn to show trends and decision consequences. All the scenarios are compared in chapter four and relevant conclusions expressed.

By conducting this feasibility study it is intended to explore the advantages of the TSL as a new sea transport vehicle and the economic consequences of its utilization. Secondly, it is intended to provide the Colombian flower industry with a viability study to consider an alternative transport solution for a more efficient flower trade.

Thirdly, this dissertation analyzes the liner service conditions and possible out comes as a result of the adoption of proposed scenarios. In addition, it is an objective to recognize the new line project's set up sensitivity not only to internal factors, but to external ones such as oil price, interest rates, gearing, freight rates etc.

Finally, another objective is to consolidate the author's understanding of the liner and high speed craft shipping segments, based on an updated, reliable feasibility study.

Chapter Two

The Techno-Superliner Technical Approach

2.1. Introduction

Currently the sea borne trade has experienced a rapid sequence of changes, from the increasing use of high speed crafts, transporting not only passengers but also cargo in containers.

Most of the newly built container ships have a range of speed from 20 to 25 knots and the trend is to transport more containers in faster ships to utilise less ships per route, reduce the turn around time and improve the frequency of the service, offering more calls per week at reliable schedules.

Despite the fact that ships of great dimensions are needed to transport increasing volumes of containerised cargo, there are some markets that, considering their special characteristics, demand a special design to cope with the specific needs.

During the second half of the 1980s, higher value added and lighter per-unit weight commodities became the standard for Japan originated cargo. Rapidly the air industry reacted to those changes adjusting the services to the new reality. As a consequence the shipping industry felt the need to win back some of the shipping business lost to airborne transport. This perceived need underlay the decision to develop the TSL as a medium -and long-term measure to help the Japanese shipping and shipbuilding industries recover from their depressed state.

In this chapter we discuss the Techno-Superliner scientific background, characteristics, historical developments and its impact on the industry.

2.2. Scientific background

The development of a high-speed craft cargo vehicle is a highly technical task. Several considerations related to the hull design are described hereunder to offer the reader the adequate basis to further comprehend its service characteristics and viability.

2.2.1. Buoyancy supporting system: This is the way of supporting the hull weight of conventional ships, by which the buoyancy of the submerged part of the hull supports the weight of the entire ship. A hull supported in this way is subject to low resistance at low speed and can be readily built in a large size, but hull resistance and hull oscillation motion, due to waves increase significantly beyond a certain speed.

2.2.2. Lift supporting system: In this case the hull's weight is supported by the lift generated on foils underwater. A typical type of craft using this system is the jetfoil. The maximum payload capacity of existing jetfoils is about 60 metric tons. A fully submerged hydrofoil craft, whose hull is above the water surface, is not greatly affected by small waves.

2.2.3. Air cushion supporting system: This system's main feature is that considerable part of the hull is lifted above the water surface by air cushion while the vessel is running. A typical example of this type of vessel is the hovercraft. The maximum payload capacity of existing hovercraft is about 100 metric tons. High speed can be readily achieved because only a small part, if any, of the hull is submerged underwater and therefore is subjected to little resistance. However, the hull is rather susceptible to the effects of waves.

Multi-supported hull types have been developed by combining the strong points of the three different weight supporting systems. This combination is the key point in the development of hull types for the Techno Super-liner.

Moreover, by using exclusively technology for conventional vessels such as displacement type vessels, which now carry the bulk of seaborne trade, the high-speed craft targets are not achievable. Neither can the R&D targets be attained, using technology for existing high speed craft such as hydrofoils, surface gliding boats and hovercraft, because although these craft are suitable for passenger transport, they are limited in terms of their cargo transport capacity. Therefore, a focal point of the project is to satisfy the speed and payload capacity requirements by combining the strong points of three different systems for supporting the hull weight (buoyancy, dynamic lift and air cushion).

2.3. The TSL's research frame and hull analysis

In this section we present and discuss the framework under which the process of design and construction of the Techno Super Liner was set up. The following information is according to the Technological Research Association of Techno-Superliner of Japan.

2.3.1. Complement technology: For the design and conclusion of the research and development project of the TSL, four research items were considered:

1. Pursuit of new hybrid hull form concepts with high performance.
2. Application of new materials and adoption of the most reasonable hull structures.
3. Sufficient and reliable to waterjet propulsion systems.
4. Sophisticated motion and ride control technologies.

2.3.1.1. Hydrodynamic characteristics: Elements such as hydrofoils and struts, of which new hull form configurations consist, have been investigated theoretically and experimentally. The feasibility of hull form concepts was confirmed through conceptual designs and manned and unmanned scale model tests.

2.3.1.2. New materials: Although adoption of new materials for some parts of the vessel such as control fins and fore and aft seals has been considered, materials for main hull bodies are still conventional, viz. aluminium alloy for the upper hulls and stainless steel for hydrofoils and a submerged body.

Reasonable hull construction is considered to reduce the hull weight and ensure safety. Structural analysis by the finite element method has been conducted on each total hull structure.

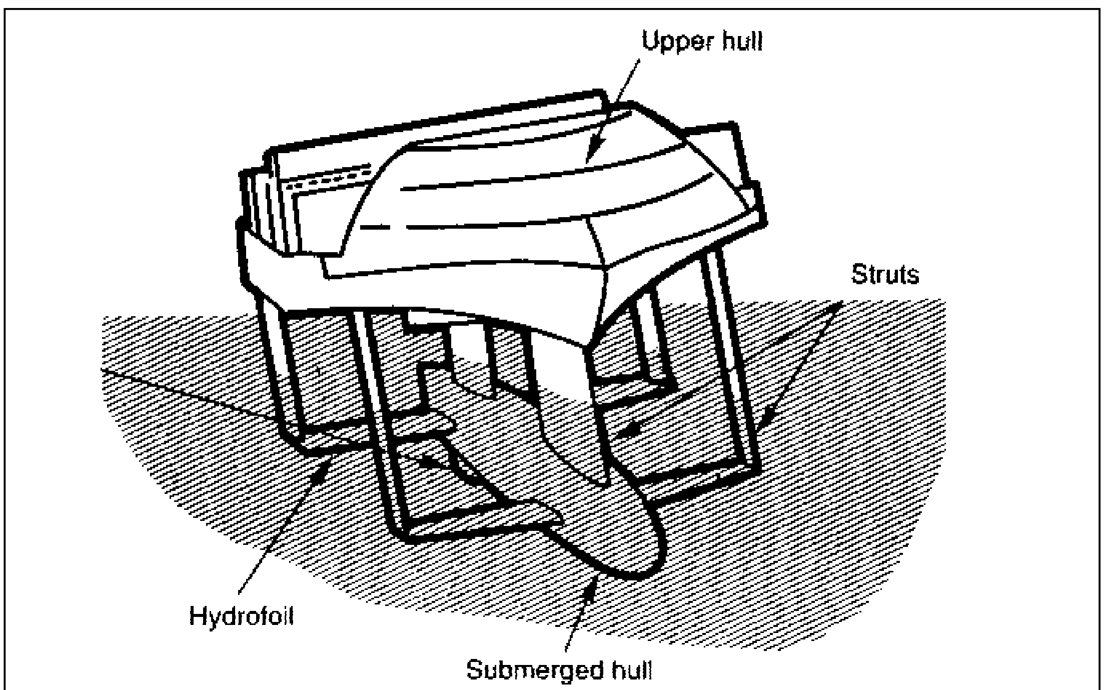
Evaluation of the strength by experiments on the partial structural models was made including fatigue tests.

2.3.1.3. Propulsion systems: This item refers to the integrated propulsion system such as gas turbine engines, transmissions, waterjet pumps and piping. For that purpose the greatest horse power waterjet propulsion system in the world, 25,000PS, was designed and produced by Japanese workshops.

2.3.1.4. Navigating improvements: Fins/flaps or regulating air pressure is another important method to maintain the ship motion tenderness and new designs were made to improve the performance of such devices. A computer algorithm for controlling the ship attitude not only in foilborne condition but also in transient condition such as take off or landing was also completed.

2.3.2. Hull designs: Under the general R&D program set up by the Technological Research Association of the Techno-Superliner, two original concepts were set up for the hull design. Both of them use more that one traditional dynamic supporting system form, which gives the generic reference name of Hybrid Hull design. Hereafter we explore the different features of each one.

2.3.2.1 Hydrofoil type hybrid hull (TSL-F): Hydrofoil type hybrid hull is a combination of fully submerged hydrofoils and a submerged bulb-like hull, which supports about a half of the ship weight, Figure 2.1.



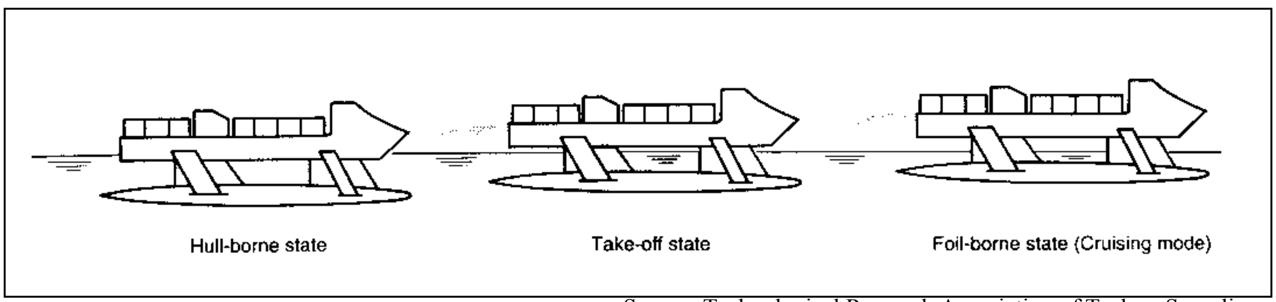
Source: Technological Research association of Techno-Superliner

Figure 2.1.
Hydrofoil-type Hybrid Hull, TSL-F

As shown in figure 2.2. the buoyancy of a submerged body and the lift generated by the hydrofoil support the ship while cruising. The impact of waves is minimised because only thin struts contact the surface of the water. This hull structure offers exceptional seaworthiness and allows the ship to maintain a stable high speed even in the high seas.

TSL-F type is suitable for small cargo/passenger ships because it possesses superior sea keeping qualities unrelated to ship size. Moreover, this particular design concept features the following advantages and disadvantages:

2.3.2.1.1. Advantages: This model offers superior seaworthiness, in particular, easy ride, because it has no hull element near the water surface except the struts.

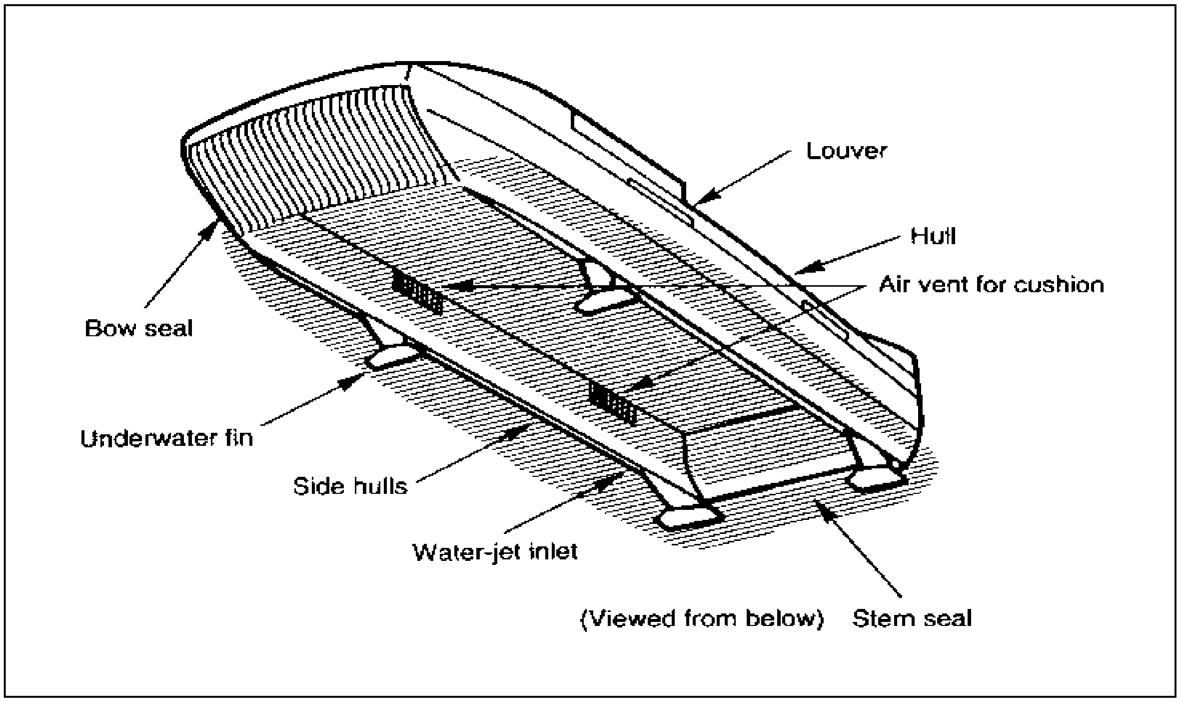


Source: Technological Research Association of Techno-Superliner

Figure 2.2.
Hydrofoil-type Hybrid Hull Performance

2.3.2.1.2. Disadvantages: On the other hand, large engine power is necessary to maintain the ship's speed by lifting the hull. Moreover, poor stability without natural restoration is a consideration that still has to improve further.

2.3.2.2. The Air Cushion type hybrid hull: This design was conceived so the ship hovers on a cushion of air blown into the space encompassed by the side hulls, the bow seal and the stern seal. As only a small portion of the hull is submerged, the ship requires relatively little power to cruise at high speeds (see figure 2.3.).



Source: Technological Research Association of echno-Superliner

Figure 2.3.
Air Cushion type hybrid hull, TSL-A

Air cushion type hybrid hull (TSL-A) are ships that are supported mainly by air pressure plus the buoyancy of catamaran subsidiary. Although it has comparatively long and narrow dimensions it features small control fins (figure 2.4.)

2.3.2.2.1. Advantages: From the two concepts this design is the most suitable to be used, mainly due to its small hull form resistance, combined with its light structural weight.

2.3.2.2.2. Disadvantages: The fragile structure of the rubber seals gives rise to concern as they could be easily damaged and consequently become a high maintenance cost not to mention a time consuming maintenance issue.

Source: Technological Research association of Techno-Superliner

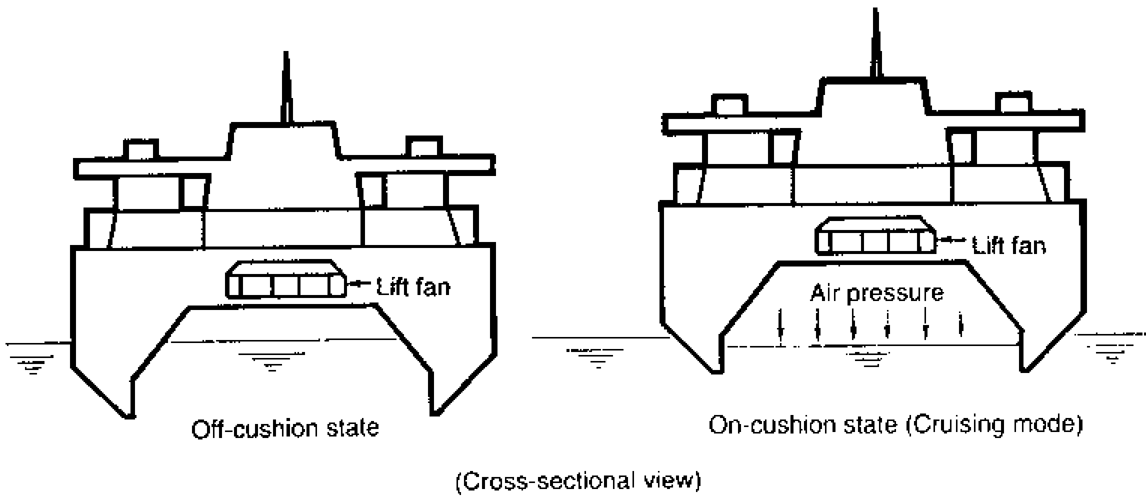


Figure 2.4.
Air Cushion type hybrid hull performance

2.3.3. Gas turbines the propulsion solution: According to Hansa report, Mitsubishi Heavy Industries Ltd. (MHI) has developed a gas turbine engine with an output of 28,000 ps for marine propulsion plants that could be used on both designs.

Although the marine gas turbine market is mainly limited to the defence field, the demand in Japan has been supplied by American and European companies. However, recent requirements for increased ship speed in merchant ships, especially ferries, have encouraged MHI to develop gas turbine engines for merchant ships. Consequently the MHI new gas turbine engine, the MTF-8 model of 28,000 was created.

The basic and detailed designs were done by MHI's Takasago Works and Nagoya Guided Propulsion System Works, respectively. The gas generators were supplied by Turbo Power and Marine Systems, Inc, (TPM) of the U.S. In addition MHI conducted manufacture of power turbine, final assembly and packaging the engine system.

2.4. The TSL project's history and evolution

The core concept for the TSL's R&D project was the idea to build a new type of ultra-high speed vessel capable of carrying a payload of 1,000 metric tons or more at a speed of at least 50 knots. Although a new container design for Techno-Superliner has not been decided definitely, at least 150 standard 20' containers can be taken aboard in two layers on deck. The expected benefit of the project was to make all Japanese islands and most Asian countries accessible to the concentrated industrial production areas, within one day. The TSL research project was started in 1989 and was composed of two stages.

2.4.1. R&D, the first stage: During the first stage of the program, **t**he elemental technologies necessary for the ship completion were studied for four years. The exploration and conduct of the designs of hydrofoil-type hybrid hull, and an air-cushion type hybrid hull, as well as the propulsion engine were also scheduled. In addition, tank tests and simulations were carried out.

For this purpose, and in order to accomplish the R&D Programme, the Association of Techno-Superliner was created in 1989, formed by the seven leading shipbuilders in Japan as shown on table 2.1.

These shipbuilding companies showed the ability to explore advanced and innovative new hull form concepts co-operatively and to overcome all fundamental technological and administrative incompatibilities. They applied their wide experience in manufacturing high-speed vessels in this project.

As part of the R&D process, engineers also concentrated on the design of high efficiency marine engines, constructed on new materials (ceramics), such as lower-tech turbines, utilising cheaper materials that will run on standard diesel fuels. Furthermore, making full use of electronic control systems, free from maintenance for six months. Then, it was expected to achieve a major breakthrough in improving the economy and reliability of marine vessels.

SHIPYARDS INVOLVED IN TSL PROJECT			
The Hayate, TSL-F (hydrofoil) type study members.			
	COMPANY	**CITY'S YARD**	**PROJECT**
IHI	Ishikawajima-Harima Heavy Industries Co, Ltd.	Tokyo Yard	TSL-F
		Kure Yard	TSL-F
KHI	Kawasaki Heavy Industries Ltd.	Sataide Yard	TSL-F
		*Kobe Works	TSL-F
	Hitachi Zosen Corp.	Maizuro Yard	TSL-F
		Ariake Yard	TSL-F
NKK	NKK Corp.	TSU Yard	TSL-F
	Sumitomo Heavy Ind. Ltd.	Oppama Yard	TSL-F
The Hisho, TSL-A (air-cushion) type study members.			
	COMPANY	**CITY'S YARD**	**PROJECT**
MHI	Mitsubishi Heavy Industries, Ltd	Shimoseki Yard	TSL-A
		Kobe Yard	TSL-A
		*Nagasaki Yard	TSL-A
MES	Mitsui Engineering and Shipping	Chiba Yard	TSL-A
		*Tamano Yard	TSL-A

Source: Technological Research association of Techno-Superliner

Table 2.1.
Shipyards evolved on the-TSL project

The main improvements of these engines are high efficiency, lower competition, compactness, reliability and low weight. All these are extremely important issues in a small size vessel required to carry cargo cost effectively at high speeds. Major overhauls would be carried out by swapping engines, reducing the time required for dry-docking.

	TSL-F	**TSL-A**
Lenth	17.1 m	70.0 m
Breadth	6.2 m	18.6 m
Depth	1.5 m	7.5 m
Draught	(hull-borne) 3.6 m	(off-cushion) 3.5 m
	(foil-borne) 2.1 m	(on-cushion) 1.1 m
SPEED (Max)	40 Kt.	50 Kt.
Main Engine	1 x 3800ps(GT)	2 x 16000ps (GT)
Propulsor	1 x waterjet	2 x waterjet
Others		4 x 2000ps lift fan

Source: Shipbuilding Technology International, 1994.

Table 2.2.
Basic Specifications of TSL Prototype Models

Parallel to the above, an initiative rose to study how to develop a suitable environment for such specialised new designed vessels. This study was framed on the following parameters:

- Marketability and socio-economic impact.
- Port functions, overland transport, and warehousing functions.
- Study on their operating performance, etc.

2.4.2. Prototype construction the second stage: In the second stage the construction of prototypes and sea trials were conducted. The purpose of the test at sea by large-scale ship models was to verify the findings of the basic studies and to obtain experimental data unavailable from tank tests. Basically the objective was to confirm elemental technologies developed in the first stage of the programme and to verify the performance of the Techno-Superliner totally at sea.

According to Marine Engineers Review, as scheduled, the TSL-F type ship model was built at the Kobe Shipyard of Kawasaki Heavy Industries Ltd. The ship was named “Hayate” and test at sea was conducted in the Osaka bay, between April and November of 1994.

The fore part of the TSL-A type ship model was constructed at Tamano Shipyard of Mitsui Engineering and Shipbuilding Co. Ltd and the aft part was constructed at Nagasaki Shipyard of Mitsubishi Heavy Industries Ltd. The two parts were joined together at Nagasaki. The ship was named “Hisho” and it was tested off the Goto Islands between July and September of 1994 and off Oshima Island from October to December of the same year.

Source: Technological Research association of Techno-Superliner

Picture 2.1.

TSL-F, prototype “Hayate” at Sea Trial

The TSL-F model was built to 1/6 scale (17.1m long upper hull/14.2 long lower hull/6.2m beam) and the TSL-A model to just over ½ scale (70m long/18.6m beam).

Source: Technological Research association of Techno-Superliner

Picture 2.2.
TSL-A prototype "Hisho" at Sea Trial

Both models are powered by gas turbine-waterjet systems. Test performances to engines were also carried out. The 40-knot cruising speed TSL-F was fitted with a single 3800shp set and the 50-knot cruising speed TSL-A was fitted with twin 16000shp sets.

Finally the Hisho prototype was passed down to the Shizuoka Prefectural government for 300 million Yen on March 27, 1996. In peacetime, the vessel is to be operated as a ferry in the Suruga Bay and as an anti-disaster rescue boat in emergencies.

2.4.3. TSL's R&D conclusions: Once all designs and trials were conducted under the auspices of the Technological Research Association of the Techno-Superliner, the following were the conclusions obtained.

The Prototype TSL-A was the one that offered better results for the carriage of containerised cargo. It offers high manoeuvrability, speed and tenderness at relatively lower power consumption, compared with the TSAL-F model.

Also it was found that a short-range voyage could afford additional cargo capacity instead of fuel. But, on the contrary, a long-range voyage further than 500 nautical miles causes cutting down on payload in order to carry additional fuel. This would mean a special arrangement for about 200 tons extra needed for extending the range by 500 nautical miles. Another solution for extending the range is to make the ship size larger or to reduce the ship speed, but this sacrifice may threaten the marketable service features.

For long sea shipping, there are three solutions, these are to make the ship larger, to reduce the ship speed or to supply the fuel at frequent stops.

Measurement	**Value**
Length	127.0 m
Breadth	27.2 m
Depth	11.0 m
Draught – Off Cushion	5.0 m
Draught – On Cushion	1.4 m
Speed	50 Knots
Cruising Range	500 nm
Cargo Payload	1000 ton
Main Engine	4 x 25,000 ps
Lift Engine	4 x 4300 ps
Propulsions	4 waterjets
Fore Seal	Full Finger Type
After Seal	Robe Type

Source: Technological Research association of Techno-Superliner

Table 2.3.

Basic Specifications of the commercial TSL-A

According with Takao Shinohara, Director General of the Japan Ship Centre in London, before the TSL can be put to effective use, a high-speed stevedoring system must be developed. It is also necessary to improve existing intermodal transportation systems involving land transportation and to develop new systems.

Listed below are some of the problems which still remain for utilising the TSL substantially as:

1. The lack of a means of adequate modal shift of cargo transportation.
2. Improvement of infrastructures such as transportation system and port and harbour.
3. Arrangement of safety rules and regulations.

But once all these problems are overcome, the TSL can be expected to have an impact upon physical distribution systems and contribute to shifts in the modes of transport.

2.5. Comments and reactions

2.5.1. Responses of the shipping industry : Although by the beginning of the 1990s the transport capacities were already overloaded, the prospect for new developments on the Asian trade promoted the expansion of shipping container liners to increase the number of ships by placing new orders,

With the Asian crisis the trade volumes reduced and increasingly imbalance of trade affected the shipping sector. However, the orders were maintained under the auspices of collapsed freight conferences, inviting a fleet expansion race.

Now, the problem of large capacities available and shortage of volumes to be transported on even bigger container ships is faced.

Taking into consideration the above, shipping lines' scepticism about the feasibility of the TSL, will presumably keep them from actively responding to the opportunities the TSL may offer to them.

The opportunities do exist because, although the existing liner services by large container ships will remain the mainstay over the long term, an increase in intra-Asian cargo traffic is a distinct possibility, as is the deployment of TSLs for transpacific trade in the 21st century.

2.5.2. Responses of the intermediaries and logistics providers: To freight forwarders, especially airfreight forwarders, the TSL means a major potential alternative to aircraft. Especially now that the air industry is so well positioned, the diversification of available means of transport would give them not only extra opportunities to develop new physical distribution routes, but also a better bargaining position vis-a-vis airlines. The spectrum of possible services to be offered to shippers would increase; competitiveness would regulate freights, with an intermediate transport mode to balance the fluctuation.

2.5.3. Responses of the trucking industry: It is expected that in countries like Japan trucking would be most heavily affected by the coastal service of TSLs. Since commodities could be transported within and between the islands at a high speed with out traffic barriers. Some of them are even interested in operating TSLs for themselves as a major alternative mode of transport with a view to strengthening their service capabilities.

In countries with bigger continental extensions and trade within the country's states the trucking service would not be so much affected. For those countries the ship would serve the import export transport on the short and may be long range.

2.5.4. Responses of shippers: Shippers are divided in their evaluation of the TSL. While many are in favour of the development of the TSL as a new means of transport, more than a few are sceptical.

According to the Technological Research Association of Techno-Superliner, the most specific expression of scepticism is that the TLS's "transit time is not short enough." For instance, if an aircraft can cover a given distance in a few hours, a TSL will do it in two days and a conventional container ship in eight days. The difference between two and eight days, according to such sceptics, means practically nothing for many types of cargo (for which the few hours by air are considered a clear advantage).

On the other hand, a much cheaper marine transport alternative does make some sense to them. Consequently, there are also active supporters of the TSL who think the sceptics' evaluation does not fit all cargo items. The intermediate position between air and sea transport modes is that TSLs can create new export and import business opportunities.

In addition to the sectors whose responses are summarised above, airlines are also assessing the likely impact of TSL introduction, to which they may actively respond, perhaps even by operating TSLs on their own.

2.6. Application of Techno-Superliner technology

In accordance with the original expectations set up by the Technological Research Association of Techno-Superliner, the build-up of transport routes to and from Southeast Asia is contemplated as the next step for the completion of the project.

It was calculated that, to take haulage from Tokyo to Sapporo the overall transit time of a TSL (including trucking legs) is expected to be around 16 hours, versus approximately 35 hours by truck, using the ferry between Tokyo and Tomakomai. Thus, the TSL will be fully competitive in terms of speed.

The TSL will be able to link Japan with many points in Southeast Asia in a day or two. If these assumptions are correct, the introduction of TSL will pose a major threat to other modes of transport.

But, further technical development must be achieved in extending the TSL cruising range, and developing viable high-power and less fuel-consuming main engines and effective bunkering systems.

If the above targets are achieved, extremely short transit time could be reached. Meaning about four days form Japan to North America (versus about 10 days for existing container ships) or about 10 days to Europe (at present about 24 days). Thus, the commercial application of the TSL as a new transport mode will have an immense impact on seaborne trade in the 21st century.

According to the Japanese Finance and Industry survey 1991, the most important point for the introduction and commercial application of TSLs, is how to establish realistic freight rates without disregarding their operators' profit level. The key factors for the freight rate structure are the price of a TSL and the current fuel price.

Another point to consider is that for sea shipping the shortening of the time for arrival/departure and cargo handling in port is rather more significant than ship speed it self. This is because the range between the voyage time and total time on a door-to-door service, with the use of the TSL will become smaller.

High-speed cargo handling facilities are needed, which can load and unload the ship in one hour, that is 150 containers, 300 movements per one hour. A committee outside of the Technological Research Association of Techno-Superliner carried out an investigation into high efficiency cargo handling facilities, which are on both a vertical lift on lift off system and a horizontal load on load off system. Another committee also investigated an automatic arrival/departure system for the ship alongside a pier.

If a cargo for Techno-Superliner is specified, the cargo handling form is defined naturally. In some cases, RO-RO system will become effective and then the Techno-Superliner will be changed into a large ferryboat. The Techno-Superliner is feasible as a cargo passenger ship with large capacity.

Chapter Three

The Flower Trade

3.1. Facts about the flower industry in Colombia

Although Colombia exports more than 50 types of flowers including Pompons, Alstroemelia, Lilies, Gypsophilia etc., only two varieties alone, account for more that 70 % of the total production, namely carnations and roses. Major Colombian flower producers claim that half of the world production of carnations comes from Colombia.

In this section we analyse several factors for the success of the Colombian flower industry; also we discuss the current market conditions and finally develop relevant topics related to the flower transport.

3.1.1. Production area: Although Colombia has practically all the thermal conditions available from tropical beaches to permanent snow mountains, the Sabana of Bogota, is the most suitable region for the farming of flowers.

The Sabana of Bogota is located in the central part of Colombia, at an altitude of 2600 meters above the sea level. In addition, the capital city (7 million inhabitants) and some neighbouring small towns, which may raise the total population to about

8.5 million people, are located here. The region covers a total area of 80,000 square kilometres.

The Sabana of Bogota produces 90% of the export flower production. This area holds the most fertile land in the entire country, sharing an extensive production of potatoes, fruits, corn (cold variety) and dairy products.

The hydroelectric plants of Chivor and Chingaza, serve the region with a 2.316 MW electricity production. In addition, the recent construction of a natural gas pipeline from the western oil fields ensures sufficient energy supply.

3.1.2. Competitive advantages: Although being placed relatively far away form the consumption area, Colombian flowers have proved to be competitive in such demanding markets as the USA, Canada and Holland. Hereunder we analyse the main aspects of Colombian flower success.

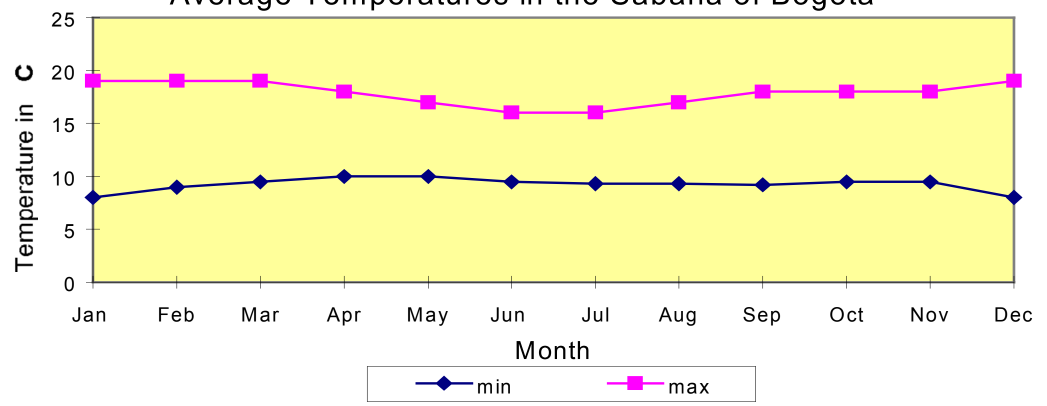
3.1.2. Labour conditions: In this labour demanding industry (at least 18 people per hectare), more than half of the production cost is wage related. This is because the human factor cannot be replaced in activities such as harvesting, selection and packing.

In Colombia 50.000 people are employed in the flower farms. Related industries employ some 75.000 people. Contrary to other similar segments of the agricultural industry, flower employees hold many privileges such as continuos job through the year, stable salary, provision of meals and transport, subsidised medical care, subsidised day-care centres and social benefits.

This stability is the main factor for the unions to establish friendly relationships with the employers, agreeing on relatively low but steady salary.

Compared to the USA where a farmer could get paid up to US$ 8.oo an hour, the average amount paid in Colombia is US$ 7.oo per working day. Furthermore, 60% of the total personnel are women, who in many cases demand even lower salaries.

Figure 3.1.
Average Temperatures in the Sabana of Bogota

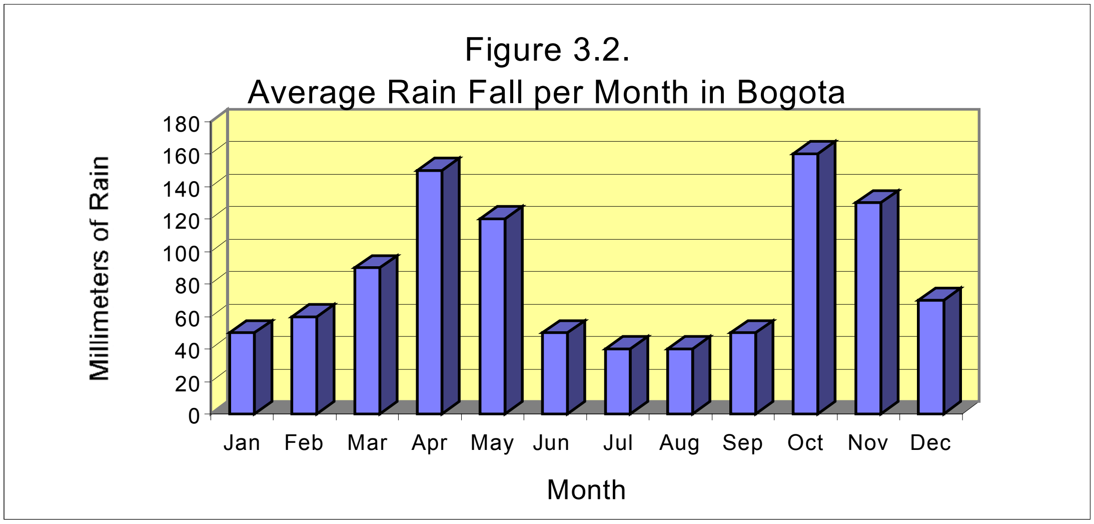


Source: Colombia - Lonely Planet

3.1.2.2. Ideal climate: The Sabana of Bogota holds an average day temperature of 14ºC all year round. The average annual rainfall is 1020 mm, affected by only three main seasons as shown in figure 3.2. This climate offers the perfect conditions to develop a highly technical agroindustrial production, as is the case of flower farming.

Countries like Holland spend millions of dollars on energy supply (gas, oil, and electricity) to operate heaters to maintain the farm's environment temperature at optimum. Roses and carnations need a temperature no lower than 7ºC, and no higher than 23ºC. If these temperature conditions are not sustained, the plant's growth rate is reduced and in extreme cases the plant will never bloom.

In addition, possible competitor countries, such as Costa Rica, lack the moderate, dry weather needed. As a consequence, due to its hot and humid temperatures, the production is concentrated in tropical varieties such as Heliconias, Musas, Maracas, Ginger and Mini Ananas.



Source: Colombia – Lonely Planet

Rarely, especially at night, the temperatures in the Sabana of Bogota may fall below 7˚C, when this happens heaters are used to keep the temperature, and consequently raises slightly the production cost. Yet, the electricity and gas supply in the rural areas of the Sabana, holds considerably lower fares than in the adjacent urban zones, not to mention the enormous difference between the cost per Kilowatt in the USA or Holland and the comparatively lower cost to be paid in Bogota.

3.1.2.3. Low cost of land: Although the price of land in the Sabana of Bogota has risen 200% in the last 15 years, it has remain of considerably lower than the amount paid in Holland where in fact the cultivable land is very limited and extremely expensive.

Moreover, roses and carnations have long production periods from the planting of seeds to the harvest. In the case of carnations, the period is 20-24 weeks, in the case of roses 36-48 weeks. Hence, only two harvests per year could be performed per field. Compared with other agricultural products, which are less labour demanding, need less care and are more productive throughout the year, the utilisation of the land for flower farming is less attractive for the USA farmers.

3.1.2.4. Economy of scale: With a high production of 137,500 tons in 1998, Colombia has achieved a highly developed economy of scale. This has been achieved by improving the utilisation of resources such as irrigation water per hectare, energy consumption per hectare, man-hours, fertiliser, seeds per hectare and time capital invested.

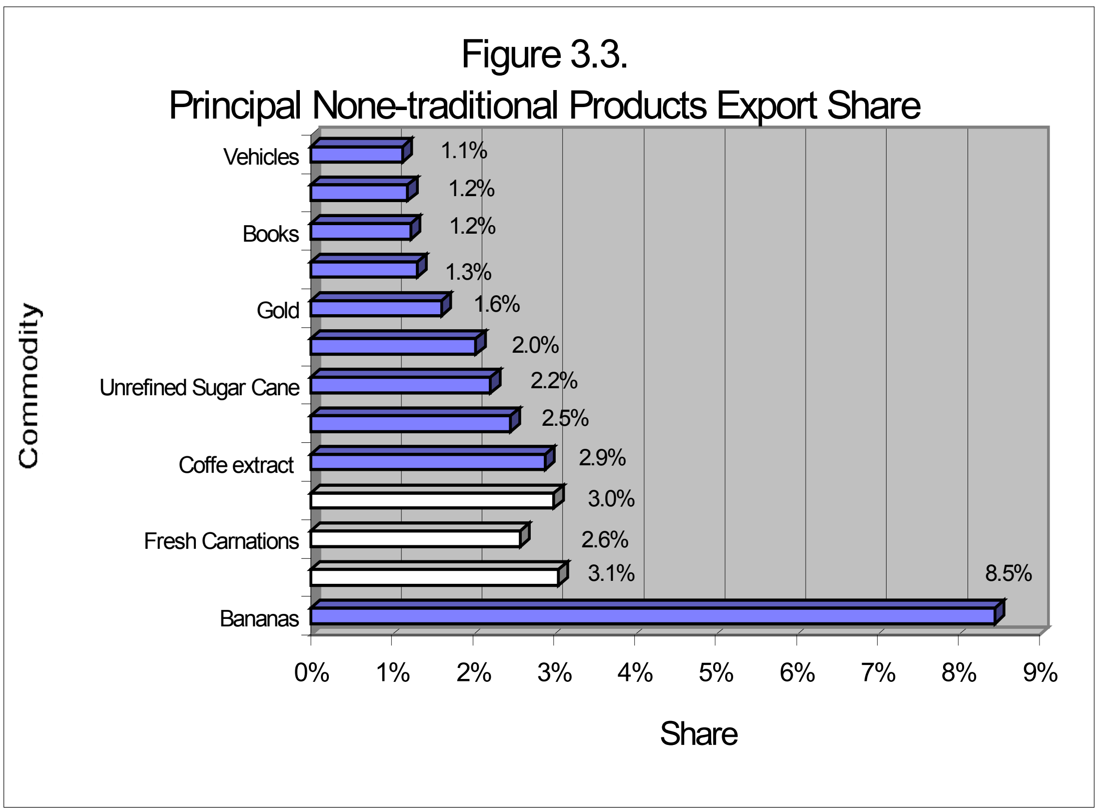
Moreover the industry supports related industries such as the carton sector, plastic producers, transport suppliers and food services, consequently obtaining reduced prices per high volumes purchased.

3.1.2.5. Tax and import concessions: Traditionally USA and EU governments establish bilateral trade agreements with developing countries. They pursue to establish the ideal "liberalisation", applying their trading partners in developing countries. On the other hand provide tariffs reductions and import concessions to producers willing to enter their market with products.

This is also the case of Colombia, which as a developing South American country, holds special concessions on agricultural products imported by USA or EU. These concessions are based on agreements, which as a counter part demand the liberalisation of the trade of other commodities such as electronics and vehicles coming from the USA and EU, entering the Colombian market.

Colombian products in general have limited concessions not only in number but also in amount. But Colombian flowers are not charged with import tariff to USA and EU. This concession is enough to present Colombian carnations and roses to the market, at very low competitive prices, if we compare them with the same product coming from within the respective local production.

3.1.2.6. Research and development: In the early stages of the Colombian flower industry, all seeds planted came from the existing plantations in Holland and California. Rapidly, local farmers mastered care techniques, moreover adjusting them and finally creating new technology, which was applicable to the particular conditions of the Andes' mountains slops.



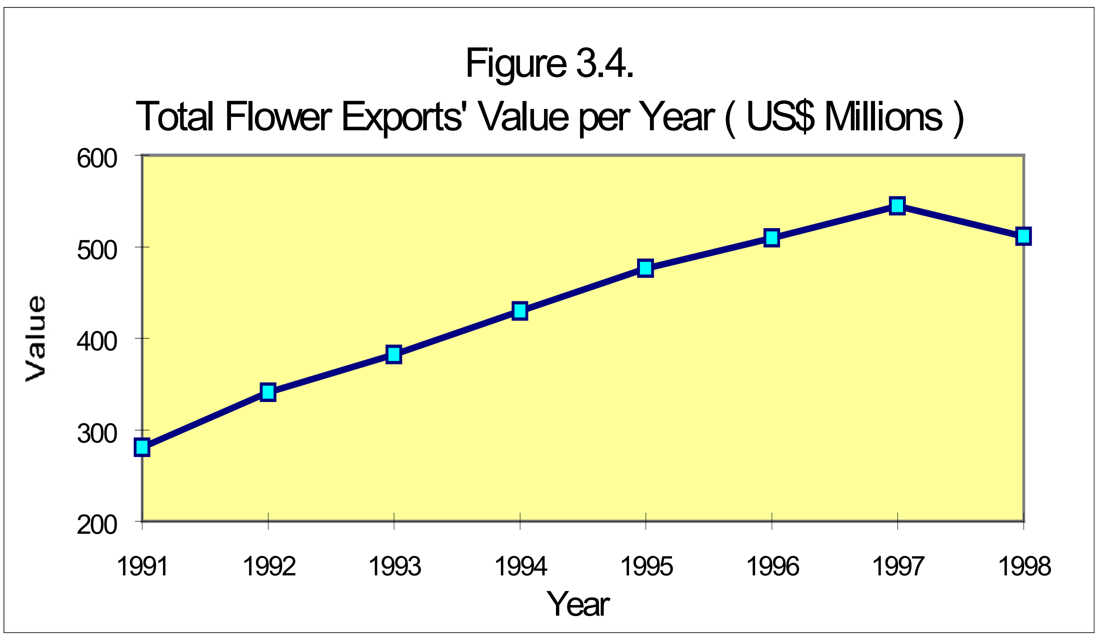
Source: Proexport

In order to meet the quality demanded in the USA market, the industry started to develop a strategy of long lasting participation on the international market, developing new, stronger and more colourful varieties and introducing improved growing techniques.

3.2. Production analysis

In 25 years Colombia has become the world's second largest exporter of flowers after Holland. Currently, the whole industry is export oriented, leaving only 5% of the production for internal consumption. Consequently, total export of fresh flower is vital for the Colombian economy and occupies second place as a foreign currency generator within Colombian non-traditional exports, after bananas (figure 3.3).

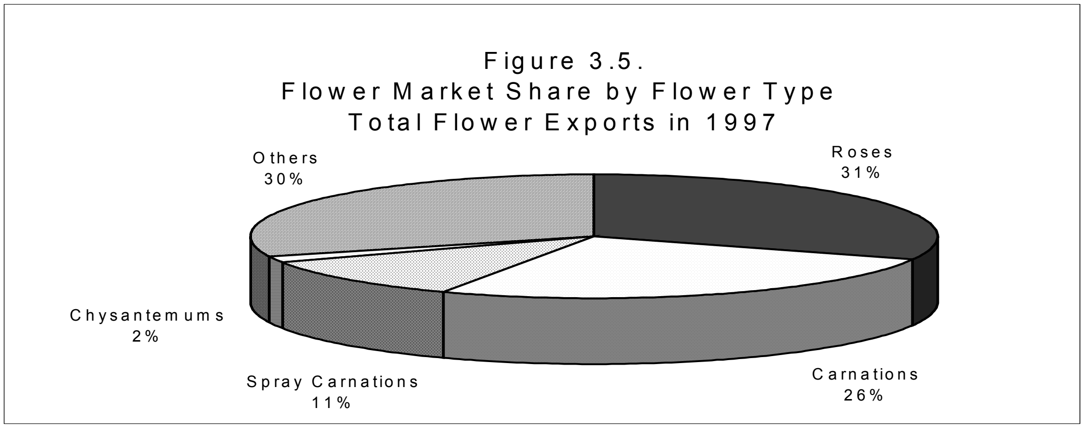
3.2.1. Production development: Since the first export shipment in 1965, valued at US$ 20,000, the industry has enjoyed rapid steady growth; the most recent figures show US$ 511 million in 1998 as the total flower export of that year (figure 3.4).



Source: Incomex

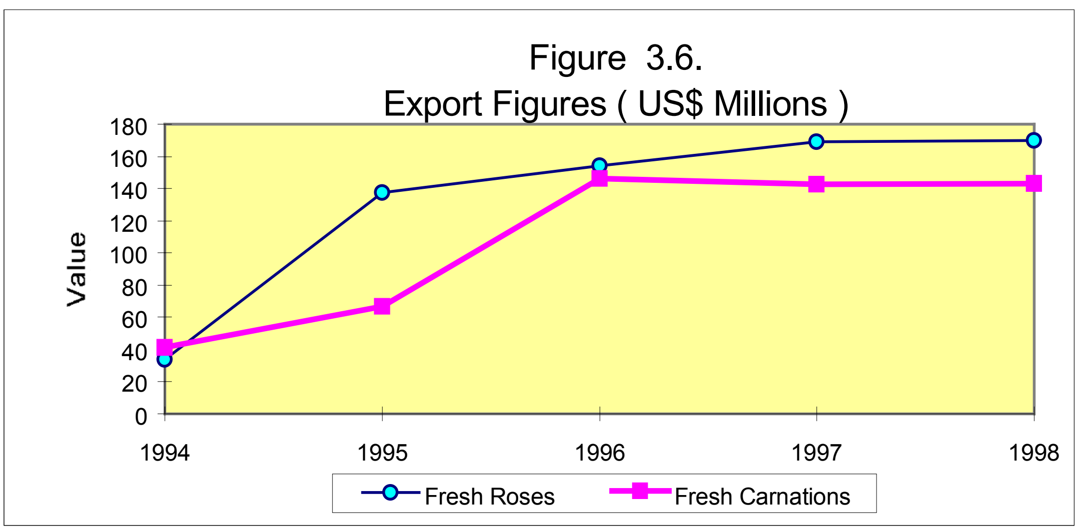
An average annual growth rate of 12.03% has been steady for two decades, only declining in 1998 when manoeuvres by competitors to ban imports of Colombian flower in the European market contributed to a slowdown in production.

3.2.2. Roses and carnations, the cash cow products: During 1997, roses were the main export product of the sector. Sales abroad amounted to US$ 169.2 millions, which represented 31.1% of the total, followed in importance by standard carnations, which generated US$ 142.6 millions in the same period.



Source: Incomex

Roses and carnations have been the principal export variety; they are preferred not only in USA but also in Europe.

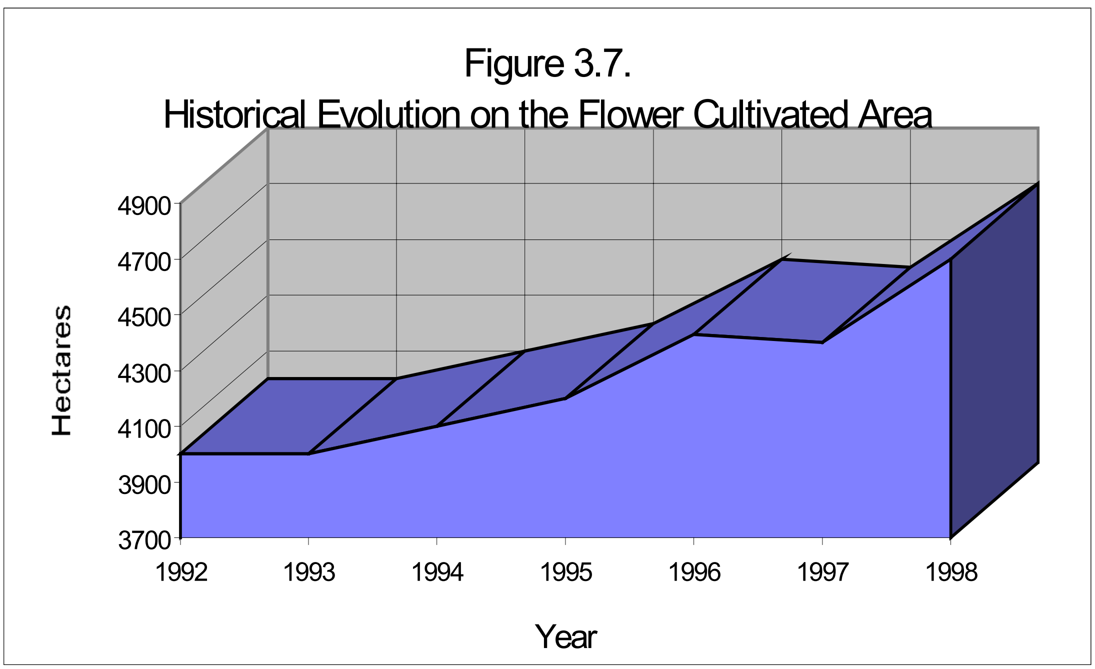


Source: Incomex

Demand of both products have growth steadily for more than 10 years and they hold an important position among the exported commodities.

In the last year the production of roses and carnations have suffered a negative growth mainly due to the reduction on exports to EU and non-EU countries.

3.2.3. Cultivated land status: Due to the increased participation in the world market, the area of land cultivated has increased enormously. In 1998 the cultivated area rose to 4700 hectares becoming the most important agricultural industry in the Sabana of Bogota (figure 3.7.).

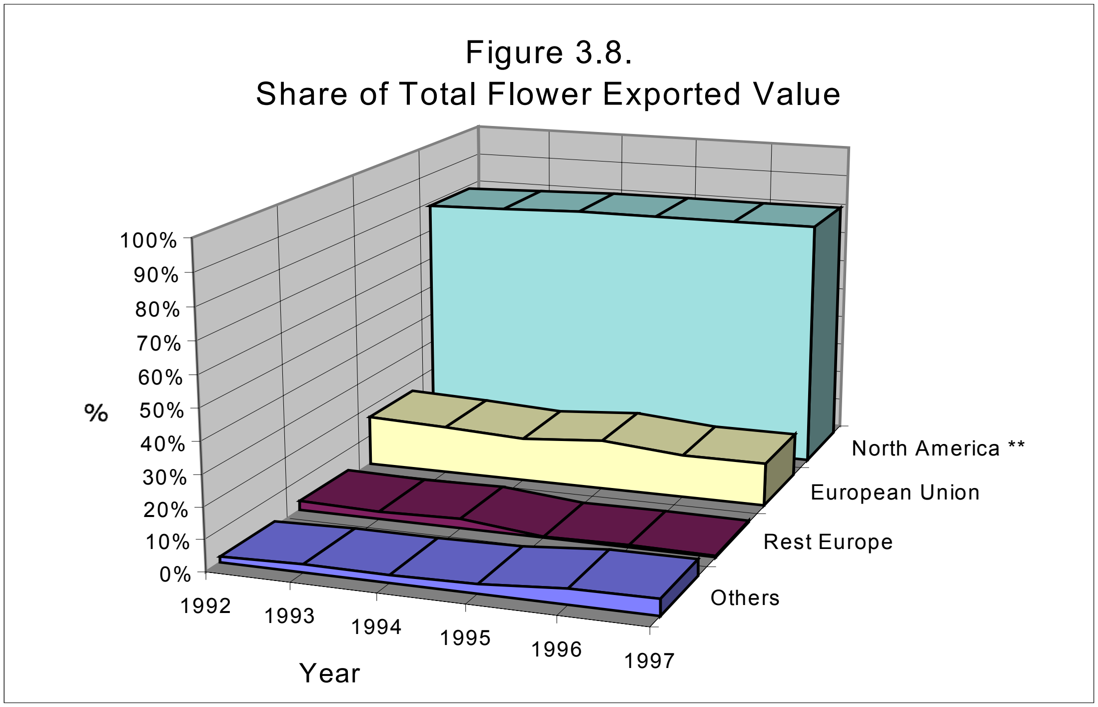


Source: Asocoflores

3.3. Total flower market analysis:

The export of flowers to international markets started mainly with destination to the USA. Historically close economic relations helped the establishment of a prosperous trade pattern, which was the base to further develop exports to other parts of the world. In that respect, exporters soon diversified the export target countries and started to trade with the EU countries, especially Holland and Germany.

Although the trade to the USA has increased every year, that is not the case with exports to the EU, which lately have faced a considerable decrease (figure 3.8.).



Source: Asocoflores

3.3.1. American market: The most important market for Colombian flowers is North America. The USA is the biggest Colombian partner on the flowers trade (detailed analysis is conducted in the next section). Furthermore, the Canadian market is of great interest for Colombian exporters; however the official figures do not reflect this because the statistics register a large portion of the sales to this country, as sales to the United States. This is due to fact that importers use Miami as the port of entry to be further shipped to Toronto, Montreal and Vancouver.

3.3.2. European Union market: The fifteen countries of the EU purchased US$ 76 million worth of Colombian flowers in 1997. This figure corresponds to 14% of the total amount exported, placing the EU as Colombia's second most important flower trade partner. Within the EU, the United Kingdom is the most important importer followed by Holland, purchasing in 1997 US$ 34.8 million and US$ 8.9 million respectively, accounting for 6.4% and 1.6% of the total amount exported.

Germany and Spain also import considerable amounts of Colombian flowers specially standard carnations and roses, importing US$ 8.1 million and US$ 7.4 million respectively.

The Russian market has generated an increasing interest among Colombian flower growers because of its great expansion potential. Furthermore, it has been the target of aggressive marketing and penetration campaigns. In 1997 the country imported US$ 6.4 million accounting for 1.2% of the total exported, which represents a 60% growth with respect to the US$ 4 million sold in 1996.

3.4. Competition

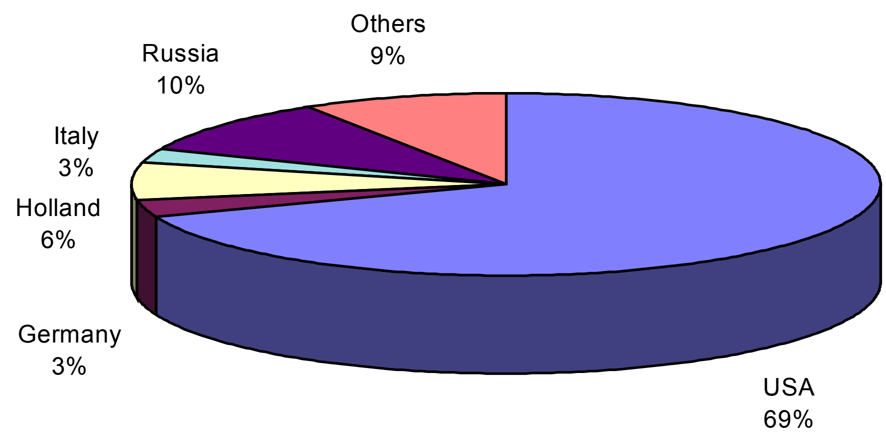
There are currently 450 companies in Colombia involved in the production or exportation of flowers. The market is so large and has been growing at such a high rate that it has been the focus of much international investment and transfer of technology.

All flower growers are grouped together under the "Colombian Association of Flower Producers" (ASOCOFLORES), which aims for the protection and further development of its market share.

In the USA market, the main competitor is Ecuador and some Central American countries that are just starting the establishment of a flower industry.

Ecuador has 150 companies related to the flower industry. After a late industry blooming, growers started exploring aggressively former closed markets such as Russia, combined with strong participation in the USA market (figure 3.9.).

Figure 3.9.
Ecuador Flower Market Distribution

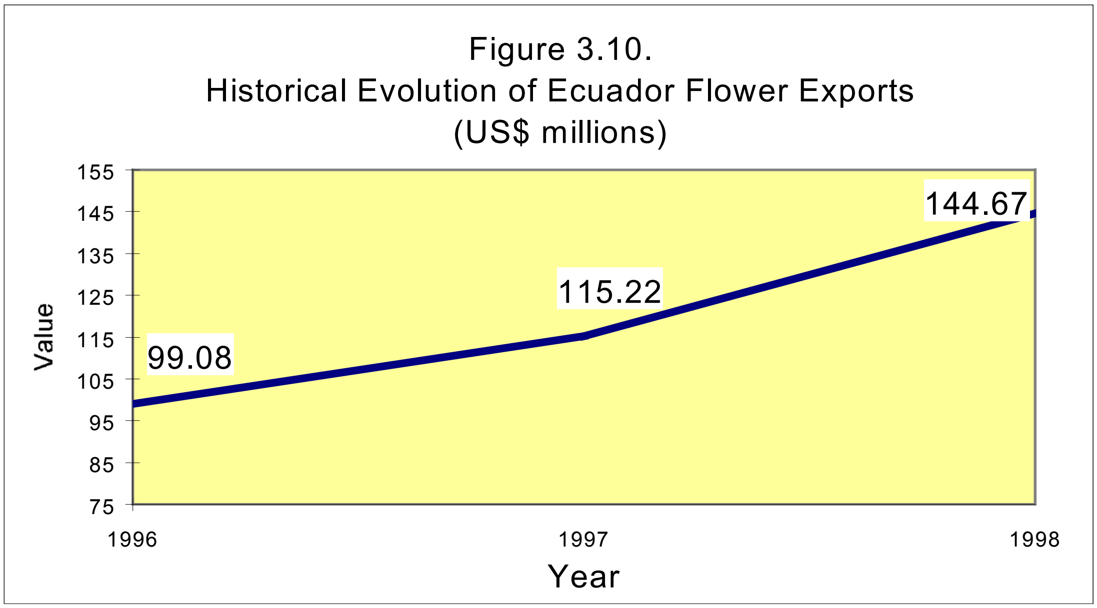


Source: Corpei

In Ecuador 2000 hectares of land are destined for the production of flowers, and close to 45000 people are employed in the sector, which experienced an impressive 25.56% growth with respect to the previous year, underlining Colombian negative 6.15% growth in the same year. A clear signal of the aggressive marketing policy adopted by the Ecuadorian flower industry in the USA.

In 1998 Ecuador exported 53,830.21 metric tons, all of them airborne.

Referring to the European market, there are several countries, some of them nearby, that offer similar flower quality and price. Israel, Kenya, Uganda and Tanzania are the representative ones. Producers from those countries are strong, active competitors in the world's most important flower market place the "Dutch Flower Auction".



Source: Corpei

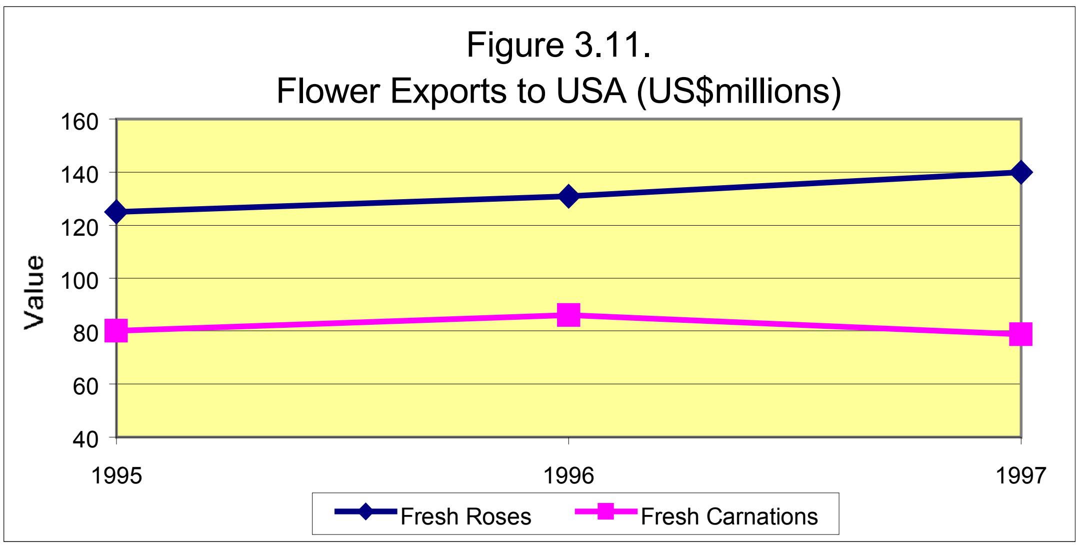
In Europe, Colombian flowers stand as the second most important in the flower trade at present, with extremely competitive products, offering superior quality and variety.

For the future growth of Colombian flower production it is extremely important to diversify the type of flower produced, and most important of all establish strong market policies to trade to unexplored areas such as Japan, China, and Australia.

3.5. Rose and carnation trade to USA

As mentioned previously, the USA is the most important market for Colombian flowers. The floral sales to USA during 1997 amounted to US$ 421 million. These sales were carried out by flying 117,403 metric tones of flowers from the cities of Bogota and Medellin mainly to Miami.

In 1997, North American consumers preferred roses, which represented one third of the exports to that country, that is US$ 140.3 million. Their second preference was carnations whose sales amounted to US$ 78.7 millions. Other varieties such as Chysantemus Pompons and Alstroemerias are also highly appreciated (figure 3.11.).



Source: Incomex

The trade of roses and carnations has sustained a steady growth, with a small growth reduction in 1998. It is expected for the future to regain the growth at a lower rate, at least sustaining the current values.

3.6. Cooling and refrigeration

Temperature is the major factor affecting the storage and transport of flowers. This is through its influence on the respiration rate of the flowers and their response to ethylene, moisture loss and physical damage. Cooling is also necessary to reduce other metabolic activity and to slow the rate of blooming.

3.6.1. Process: The refrigerated preparation for transport of flowers has specific characteristics different from other perishable products. Two methods may be applied, cooling and pre-cooling.

3.6.1.1. Cooling: Consists of packing the flower in a refrigerated unit or cold room to maintain low temperature and high humidity. The cold room must have high relative humidity, good ventilation and reliable temperature control. Growers use this method after harvesting.

3.6.1.2. Pre-cooling: This method is used at importers' stores or throughout the retail and sale period. It consists basically of quickly taking away the heat from the flower. Pre-cooling units are fitted onto a wall in the cold room and the boxes are stood up against them with the lateral holes of the boxes against the fan. A flow of cold and humid air passes though the box removing the heat quickly and effectively. Those who reship the flowers in their original boxes use this method.

In the above operations, a relative humidity of 80 % to 98% is strongly advisable, especially for flowers not standing in water. The cheapest method is to add a humidifier to the cold room or container.

Finally, a good ventilation rate is recommended, especially because the circulation of cold fresh air among the flowers removes excess heat and will prevent evaporated water from condensing on top of the flowers. It is recommended to have a complete change of air in the refrigerated space every hour.

3.6.2. Effects of the lack of refrigeration.

3.6.2.1. Respiration: Temperature directly affects the respiration rates of cut flowers and foliage. High respiratory activity not only generates heat around the flower but also uses up stored reserves within the flower.

By keeping the flower temperature low, the respiration rate goes down too. Temperatures close to 0˚C are recommended for maximum decrease in respiration activity.

3.6.2.2. Ethylene: some vegetables, fruits and flowers produce this gas naturally. It is a hormone that speeds up the ripening process of the plant and therefore cuts down its longevity.

Ethylene causes premature death, the flower petals fall down but in high quantities it can stop the development of the flower completely.

The ethylene damage is irreversible, but, maintaining the flower at low temperatures and high ventilation rate, allowing the continuous change of air, can prevent it. This gas is produced also by some combustion engines specially the ones used by forklifts and heating systems, in consequence the ventilation of the cargo areas must be excellent, to prevent flower contamination.

3.6.2.3. Moisture loss: Flowers are very sensitive to moisture loss. The difference between the humidity of the product and the humidity of the air is the driving force behind moisture loss. Both high Relative Humidity (RH) and low temperature are important in reducing moisture loss from flowers. At 0˚C and 80% RH moisture loss is twice as much as the loss experienced at 0˚C and 90%.

3.6.3. Particulars about Refrigeration of Roses and Carnations: Although normally, most flowers need to be refrigerated in order to be transported, each species needs different special conditions. In this particular case study, an analysis is made on those requirements for the two varieties subject to our attention, roses and carnations.

3.6.3.1. Carnations: Carnations are particularly sensitive even to small amounts of ethylene concentrations. Consequently, they have to be treated with Silver Thiosulfate (STS) at the grower level, during hydration, to protect them against the gas. This treatment can increase the life of the flower by 75%.

Therefore, during the transport and storage the most important factor to prevent ethylene contamination is temperature control. Even at temperatures of 8˚C carnations may suffer serious damage. The most common is the so called "sleepiness" which consists of the shovelling and browning of the petals that can result in total non-opening. Carnations are best kept at 2˚C to 5˚C, and they can be held for one week at 0˚C to 1˚C, but they must be packed and maintained dry in the box. Finally, carnations must be stored at high humidity to ensure prolonged life.

3.6.3.2. Roses: Roses are very sensitive to water loss. If the rose lacks water the stem will bend at the neck beneath the flower head. Therefore, it is advisable before packing, to place roses in clean plastic buckets with water at 7˚C as it contains less air than cold water, allowing the liquid to travel better up the stem.

To be transported and stored, roses must be kept at temperatures of 2˚C to 5˚C, but at temperatures of 1˚C to 2˚C roses can be kept for 4 days without water, but at high humidity levels. On the other hand, roses are tolerant to high levels of ethylene gas.

3.7. Current procedures for the transport of flowers.

All flowers in general are very delicate commodities, sensitive to time and temperature. Therefore, cut flowers in general must be subject to several treatments before shipment and during the transport operation.

The preparation and shipment goes as follows: After harvesting the flowers are transported to the post harvest facility where they are sorted and bunched by colour, grade and quality. Each bunch is sleeved and placed in preservative solution to condition the flower and improve longevity.

After a couple of hours, bunches are packed in carton boxes and pre-cooled to 2˚C to 4˚C. The boxes are palletised and transported to the airport in refrigerated trucks to be loaded into cargo or passenger air planes to the destination, mainly Miami or Amsterdam. In Miami, the boxes are transferred from the aeroplane to a refrigeration chamber at 2˚C temperature and 90% humidity. There they will wait to be delivered to the final destination within the US, Canada or even Europe (figure 3.12.).

Individual packing to transport flowers has been standardised to carton boxes of dimension 105 cm x 55 cm x 21 cm fitted with holes on two lateral sides, for air flow. Each box may hold 10 packages, each one with 25 roses. But 35 bunches each one with 25 carnation stems could be packed. The average weight of a flower box has been set at 18 kg.

Specialised companies, which charge US$ 10 per box, conduct the road transport, on a journey that takes about 3 hours.

Once in the airport the flowers are transferred into the plane. This operation is time demanding, since due to the volumes there is a very high possibility of waiting queuing.

Figure 3.12.

Current Principal Characteristics of Flower Transport

Pre-cooling	**Road Transport**	**Air transport**	**Road transport**	**Storage**
2˚C - 4˚C	1˚C -2˚C	0˚C	1˚C -2˚C	2˚C
	3 hours	4 hours	2 hours	

Source: Hugo Nino

Few airline companies are specialised on this type of cargo. The most recognised are Aerofloral and Martinair, which operate pure cargo aircraft, such as MD-11F with a maximum pay load of 90 tones or 450 cbm. The service, with a daily frequency, takes 4 hours from Bogota Airport to Miami Airport. The freight is on average: US$ 1.75 per Kg. In addition, palletised boxes may also be transported in cargo compartments of passenger jets.

The above described modality of flower transport, has been the only effective way to send flowers to USA and Europe. Some entrepreneurs have sporadically tried to send flowers by ship, but with terrible consequences. The sea leg takes about 2 to 3 days and the time in port is excessive. As a consequence fully loaded containers have been lost.

Now that an analysis has been made of all aspects of a new innovative fast craft, the TSL, and discussed the characteristics of the successful Colombian flower market have been discussed, the next step is to explore the possibility of combining these two elements on a revolutionary service, presenting an alternative transport solution, for the flower trade.

Chapter Four

The Alternative Transport Solution

4.1. Introduction

The project such, refers to the establishment of a liner service using TSL, between the north coast of Colombia and the Port of Miami, focusing on the viability to transport traditional air cargo, in particular flowers from the production centers in the Sabana of Bogota, to the distribution centers in Miami USA.

Individual elements of the present transport project have been widely analyzed in the previous chapters, namely the transport mode (TSL) and the niche market (Flower Sector). The next step is to consider various predicted scenarios, as tools to decide the commercial, financial and technical viability of the project.

The service must be able to offer a high frequency of 48 hours, fixed departures and competitive freights.

4.2. Financial assumptions

To set up the regular line is highly capital intensive. Starting with the cost of the ship, US$ 95 millions, the initial investment could go up to more than 120 millions depending on the number of new containers to be purchased and other administrative costs also.

The interest rate is 7.5% on the first loan as well as on the possible ones following, if there is a need for cash to cover previous financial expenses or current losses. The capital cost is the most critical element in the project. Yet it does not depend on any operational variation and the value occasionally goes higher than the bunker cost.

The project's life is considered to be 15 years, although the ship life could be even longer. However, since the TSL is an entirely new design concept, an extremely cautious approach has been taken regarding the vessel's life span. The hull is entirely constructed in aluminum and the gas turbines as well as the waterjets should have a longer operational life than the diesel engines and traditional propellers.

At the end of the project, the ship is sold for 6% of its original price but this figure could be higher depending on the market conditions. In all cases the ship is straight line depreciated to zero over a period of ten years. The short period of depreciation was chosen to correspond with the annual period of authorization of the loan. Other types of depreciation were not considered.

To obtain our net cash results, a hypothetical figure of 33% for taxes was considered. However, this value could go down depending on the country of registration. Therefore, the calculations of the Net Present value and the Internal Rate of Return on each hypothetical scenario were based on the net cash before tax, not considering the depreciation.

Another important consideration for the future calculations is the fact that the ship is predicted to work only 48 weeks per year. This reduction of 4 weeks on the total time available per year is due to possible voyage cancellations, which must be expected due to weather conditions. Also, we must consider at least one week for repair maintenance or dry-docking depending on the period of the project's life.

4.3. Voyage costs estimates

4.3.1. Fuel Cost: This is the most important cost of the entire project, since the cost of speed is very high due to enormous quantities of fuel consumed. At 50 Knots, each gas turbine consumes 173 grams of gas oil per hour per PS at 45 knots the consumption goes to 182 gr. per hour per PS.

Current prices were used for the calculations, Although prices appeared to increase on the long term bases (table 4.1.).

Oil Prices			
Fuel Oil 380	Fuel Oil 180	Diesel	Gas
49.50	52.75	131.00	141.00

Source: Mobil

Table 4.1.
Current Market Oil Prices

This item also includes the diesel consumption of the four diesel engines that drive the lifting fans. At a rate of 120 gr./hr./PS, this figure represents 10% of the total bunkering cost per year.

Finally, an annual increase of 2% is included to cover an increase in fuel consumption and possible increase in fuel price.

4.3.2. Port charges: This is the second ranked voyage cost in order of importance. The figure is composed of the cost of cargo handling and the fixed port dues. Obviously, this cost is highly influenced by the number of containers transported so it is directly related to the Load Factor each year.

For the purposes of calculations, we assigned the value of US$ 120 in Colombia and US$100 in Miami per container movement, plus US$ 120 additional per container, for expenses related to the refrigerating container care while in port premises.

A fixed US$ 2,000 and US$ 1,800 in Santa Marta and Miami respectively, corresponds to port charges, since the ship stays an average of 1.5 hours for port operations and no more than 3 hours in total including access canal time. This price may look low but we must bear in mind that the ship's capacity is only 1000 tons and that the charges for pilot could be avoided due to the size of the ship and the experience of the officers.

4.3.3. Stores: This cost is located under the title "others" and has been fixed to US$ 200,000 for the first year and an increase of 3% per annum.

4.3.4. Victualling: It is fixed as US$ 10 per man per sea day. In our case, every day there is at least 18 hours of navigation so all of them are accounted.

4.4. Operating costs estimates

4.4.1. Crew cost: Traditionally, the most significant of the operating costs, in this project the crew cost is reasonably low compared with other projects. For this item, we calculated a crew of 11, since the engine room is unattended and the officer on the bridge performs both duties. Master, Chief Engineer and four Dual Purpose

Officers plus four Dual Purpose Ratings and a Cook are all the crewmembers. The crew would be entirely Colombian nationals, and since very qualified personnel are needed they will be paid as Spanish crew; this value is 30 % more than what the normal wages are. The total value goes up to about US$ 500.000.000 per year.

The cost is reduced further yet, because these is no need for a stand by crew since the new labor regulations admit the figure of integral voyage salary. Moreover, the cost for travel expenses is negligible because the change of crew will be conducted in Colombia.

Crew Costs			
Crew	**Number**	**Salary / Month**	**Total**
Master	**1.00**	**6,700.00**	6,700.00
Chief Off	**1.00**	**5,350.00**	5,350.00
2nd Officer	**1.00**	**2,800.00**	2,800.00
3rd Engineer	**1.00**	**2,800.00**	2,800.00
Chief Engineer	**1.00**	**6,600.00**	6,600.00
2nd Engineer	**1.00**	**5,350.00**	5,350.00
Dual Purpose AB	**4.00**	**1,640.00**	6,560.00
Chief Cook	**1.00**	**1,640.00**	1,640.00
Total Crew No.	11.00	**US$ Per Month**	**37,800.00**

Source: Drewry

Table 4.2.
Legal crew wages - Spanish crew.

4.4.2. Repair and maintenance: This is the higher of the operating costs and it includes an accumulated amount for periodical dry-docking. The cost is calculated on the basis of US$ 500 per hour navigated, and it is increased by 7,5% annually to cope with the high expenses of later years.

4.4.3. Administration: This cost was settled at 2 % of the original new building price and should increase by 2% per annum. This cost is substantial because it includes the advertising and marketing of the service, as well as the annual wages and office rent.

4.4.4. Insurance: The insurance premium for both P&I and H&M was fixed at 1.5 % of the new building price with an increase of 3 % per year due to age and possible claims.

4.4.5. Registration: Set out under the title "others", it is based on actual charged value and was set at a fixed US$ 10,000 per year This value could be less if we consider the registration on an open registry such as Panama or the Bahamas.

4.4.6. Container costs: This cost, also set under the title "others" was calculated on the basis of capital cost per container to be equal to US$ 750 and R&M equal to US$ 300 per year. This value is considerably high if we take into account that by the end of the year 15, close to 950 containers will be needed for a container slot ratio of 12,2. This result from calculations is quite high, but we must consider that the service will have a high frequency and also the container turn over time in the USA is higher than in Colombia. This is due to the fact that the distances where it could reach are extremely high compared with the limited area where the containers would go in Colombia.

There is another cost we must consider, if we are to obtain a reliable figure on the total profit at the end of each period, which is the cost of new containers purchased. The first containers to start the service are included in the loan. Every time the transport volumes increase and there is a need to purchase more boxes, the cost is included. In addition, since US$ 32,000 is the cost for a H 40' and US$ 28,000 for a 20' container, the amount could reach considerable proportions.

4.4.7. Lubes: These are also included under other operating costs with an increase or 2 % per year, due to wear of the machinery.

4.5. Project's technical build up and economic evaluation

4.5.1. Scenarios: Based on the above considerations, 15 different scenarios were proposed and equal number of calculations conducted. An analysis of the economical consequences of each was conducted, giving us the basis to support our conclusions.

We consider firstly a so called worst case scenario in which, due to poor market penetration, the load factors in the first years of the project are relatively low, only catching up to good acceptable percentages at the beginning of the 4th year. This condition could be avoided by offering a substantially cheaper service than the one offered by the air industry.

This "worst" case becomes more critical if we consider absence of equity participation, so the capital cost per year would highly increase. The scenario is designed to analyze the project's behavior under extreme critical conditions.

Other conditions that are more favorable are set up with the mark "Best", which refer to optimal market penetrations from the project's very beginnings. Starting with a loading factor of 50% in the first year, but obtaining a utilization up to 75%, 85%, 90% and 95% from then on. A more realistic 30% equity share on the investment is fixed since the project could have very high rates of returns, per year, so we assumed private investors would be interested to invest.

Proposed Scenarios																
Issue		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Container Size	(ft)	20'	H 40'	H 40'	H 40'	H 40'	H 40'	H 40'	H 40'	H 40'	H 40'	H 40'	H 40'	H 40'	H 40'	H 40'
Speed	(knot)	50	50	50	45	50	50	50	50	50	50	50	50	50	50	50
Stop for Refuelling	(Y/N)	N	N	Y	N	N	N	N	N	N	If need	If need	If need	N	N	N
Port Cargo Handling	(C/hr)	62	62	62	62	62	62	62	124	31	62	62	62	62	62	62
Freight per Kg.	(US$)	0.7	0.7	0.7	0.7	0.70	1.05	1.40	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
% current air freight	%	40%	40%	40%	40%	40%	60%	80%	40%	40%	40%	40%	40%	40%	40%	40%
Load Factor	(B/W)	Worst	Worst	Worst	Worst	Best	Best	Best	Best	Best	Most 85%	Most 90%	Most 95%	Best	Best	Best
Equity	%	0%	0%	0%	0%	30%	30%	30%	30%	30%	30%	30%	30%	0%	30%	30%
Interest Rate	%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	15%	7.5%
Oil Price		1,999	1,999	1,999	1,999	1,999	1,999	1,999	1,999	1,999	1,999	1,999	1,999	1,999	1,999	1,991

Source. Hugo NIno

Table 4.3.
Proposed Scenarios

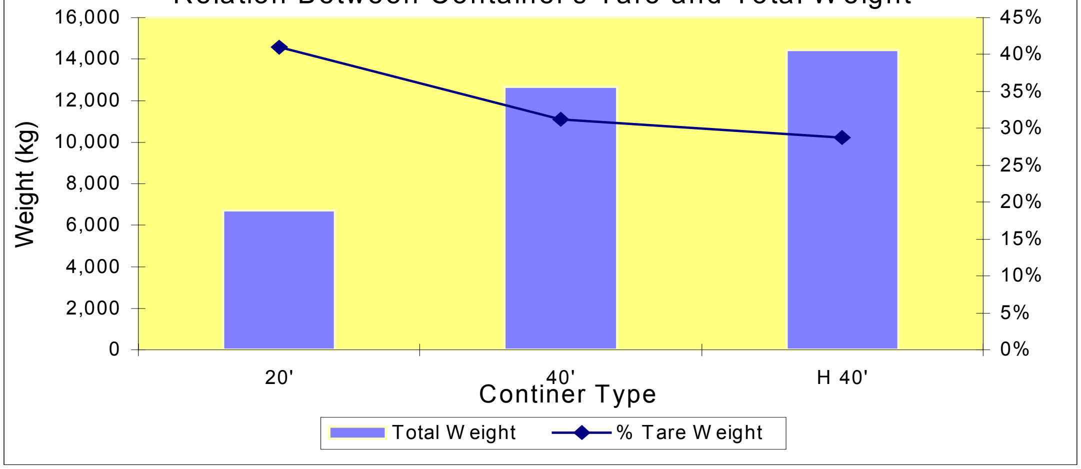
4.5.2. Container size selection: The first decision to start with our calculations is whether to use dry of Ref., 20' or high cube 40' (H 40') containers for the transporting of our export product "flowers". At first sight, one could conclude that since flowers are a very light commodity, it is basically a volume product so it must be stuffed in H 40' containers, but what are the economical implications to support that decision?

Since flowers, as any other perishable product, must be refrigerated to be transported, we decided to use for our calculations the costs that refrigerated containers involve. Moreover, since the TSL is a weight sensitive ship we selected aluminum as the material for container construction. This fact slightly increases the value of the investment, but also increases effectiveness of the ship's payload capacity.

As discussed previously, the transporting of flowers has been standardized in carton boxes of 1050mm x 550mm x 190mm and an average of 18 Kg per box, for 0.10 m3 per box. Although 20' containers are suitable to transport many different kinds of cargo, the relation between the empty container tare weight and the volume capacity is considerably inferior to the one offered by H 40' s.

In a 20’ container we can pack a maximum of 220 boxes compared with 572 which could fit on a 40’box. This is an advantage of 160% more cargo utilization compared with an increase on the tare weight of 50% between a 20’ and a H 40’ container.

Figure 4.1.
Relation Between Container's Tare and Total Weight



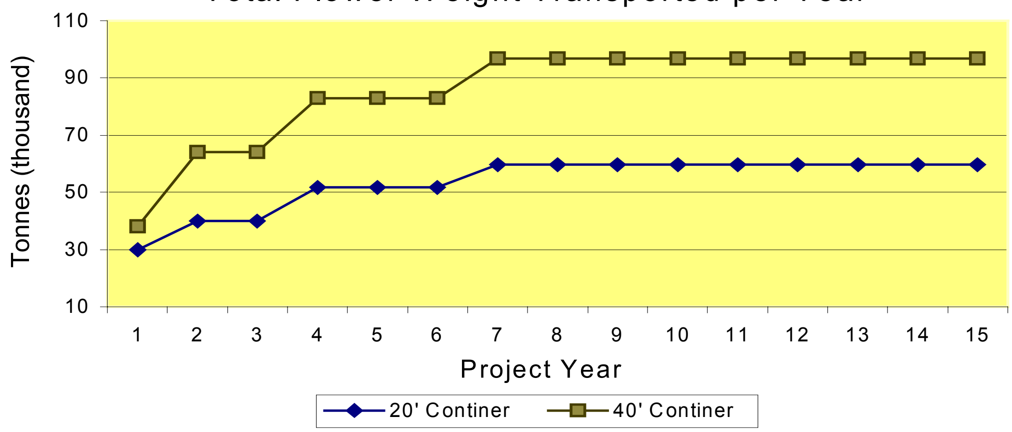
Source: Hugo Nino

This improvement on volume utilization will have great significance on the amount of cargo transported per year and, of course, the total revenue as shown in Figure 4.2. the total carried tonnage per year could increase by an impressive 62% by using high cube 40’ containers.

By using 20’ containers it is not only that the revenues collected are lower, but the initial investment and the cost of capital is even higher since double the number of containers must be purchased to obtain the correct container / slot ratio. The price for a 20’ ref. is only slightly cheaper than the price of a H 40’. Moreover, if we consider the use of 20’ containers, the profitability of the whole project is questionable since we can see a drop of 5 points on the already low IRR, if we compare case No. 1 and case No. 2.

In addition, the maximum payload that a H 40’ could stand is 28,350 Kg, close to three times more than the weight of the 572 flower boxes (10,296Kg) that could be fitted inside. This gap gives us a very high safety factor for cargo handling operations in port and also formidable space utilization, leaving 5 m3 inside the container, as space necessary for cold airflow, facilitating the cooling process and the renewal of enclosed air.

Figure 4.2.
Total Flower Weight Transported per Year



Source. Hugo Nino

In our particular case, if we consider the above statements on one hand and the fact that flowers have a stowage factor of 6 cubic meters on the other, it is advisable to use only high cube 40’ containers since they permit the transport of more flower boxes, utilizing better the limited TSL’s 1000 tons of payload capacity available.

4.5.3 Port Selection: This is probably the most critical influence factor for the successful conclusion of the project, after fuel consumption. Issues such as port selection and cargo handling are discussed hereafter.

For the selection of ports we fixed a simple criterion to be fulfilled by proposed ports: speed. This speed should be in all areas namely: channel crossing time, cargo handling, authorities dispatch and availability of complementary intermodal transport facilities and market reach.

On the Colombian side, three ports are proposed, all of them located on the Caribbean coast, Cartagena, Barranquilla and Santa Marta. Cartagena is the port that moves most containers in the Caribbean with 277,286 in 1998. The efficiency of the port has been improved 300% in the recent years. However, it has a long 2500 Km highly transited access channel, passing though a populated bay on which the navigation is restricted to a maximum speed of 15 knots.

Barranquilla's port, on the other hand, is located in an industrial area suitable to the trade of finished products, chemicals and raw materials. But it is situated in the third biggest Colombian city which makes it a highly congested area surrounding the premises, presenting continuous truck traffic and poor road conditions. Moreover, the port is located up a river stream with an access canal of 4 Km length with dangerous stream conditions and navigation restrictions.

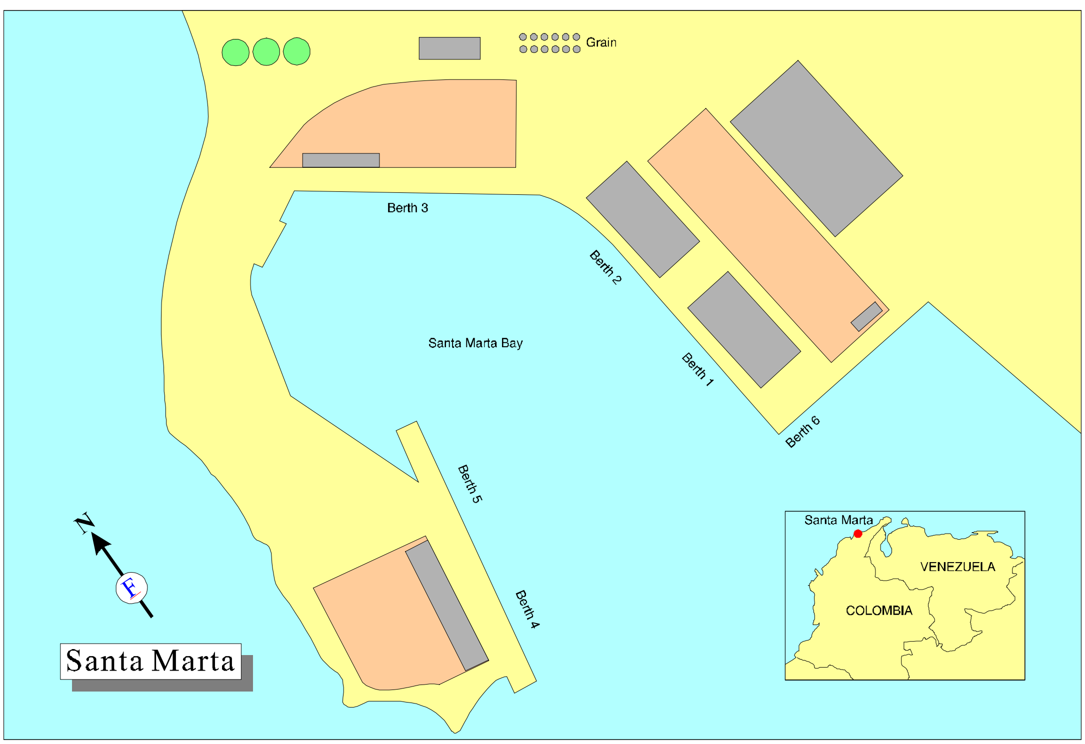
Total Cargo Movement by Port (Thousand of tons per Year)		
Port	**1997**	**1998**
Cartagena	1,889	1,885
Barranquilla	1,455	1,539
Santa Marta	3,042	2,885

Source. Manuel Campos

Table No. 4.4.
Total Cargo Movement on Colombian Caribbean Ports

Santa Marta's port is the most northern port in the Caribbean and thus the closest to the destination, 70 miles closer than Cartagena (1 hour 24 minutes at 50 Knots). It is a highly specialized bulk port (grain, copper, and oil) with high volumes moved per year, but with low sea traffic conditions. It is located in a very small bay protected by a breakwater, with a very short access channel and a low container berth utilization ratio, ensuring port space at all times (figure 4.3.). Furthermore, the port is located in a small city of 600,000 inhabitants with very few industrial activities different from tourism and the port itself. In addition it has a good supply of well maintained and clear roads.

All three ports a have lack of convenient cargo handling facilities, such as modern gantry cranes to serve efficiently the TSL. Consequently, this is a disadvantage for all of them, to be subject of discussion further ahead.



Source. Fair Play

Figure 4.3.
Lay out of Santa Marta's Port - Colombia.

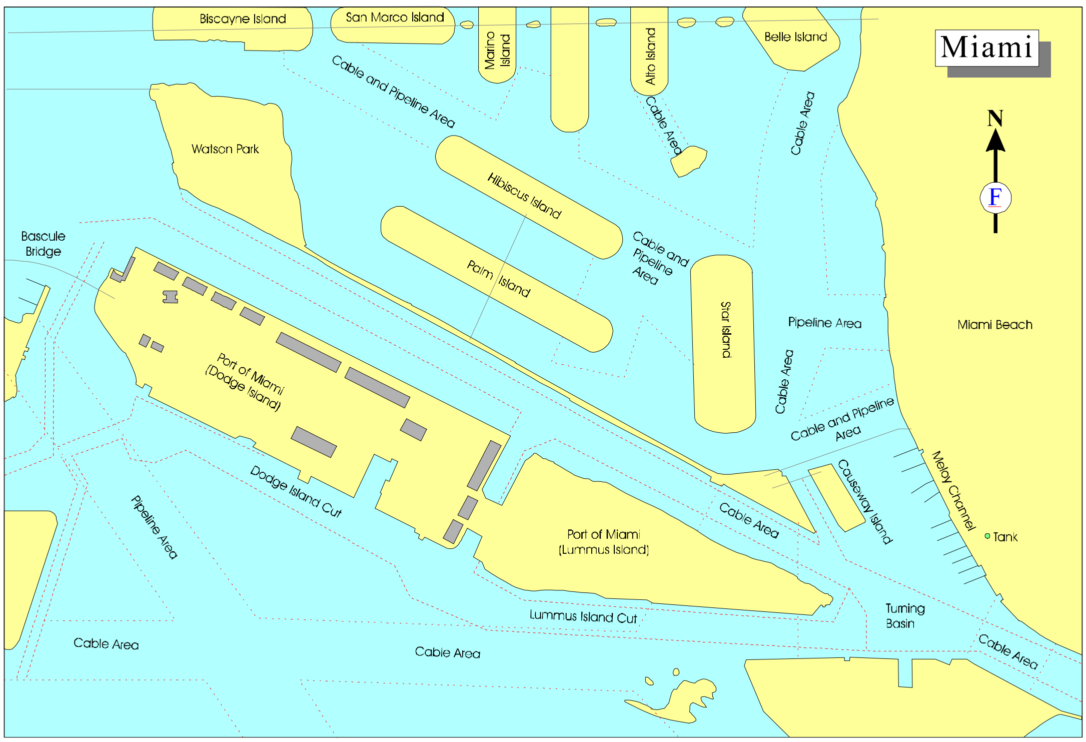
Since our niche product is flowers, which are produced in the center of the country, the difference in road transport price from one coastal port to another is negligible. Since **Santa Marta's port** is the most suitable in terms of fast road access, fast and clear ocean access, fewer arrivals and fast authority clearance, with a container berth availability at all times, it is the most suitable solution on the Colombian side.

On the USA side there are several possibilities considering existing attractive conditions in Jacksonville, Fort Lauderdale, Pensacola and Tampa. But, Miami's port is the most suitable due to the fact that it is located at the south eastern edge of the Florida peninsula, which is considerably closer to Santa Marta than the others. Therefore, only the port of Miami offers the required fast access to the flower market place.

The city of Miami, is the location where the flower trade is organized, not only within Florida but also to the rest of the USA. With more than 200 commercial listed flowers companies moving up to US$ 500 million in 1998, Miami is the most important flower market in America.

The logistics for the commercialization of the product are already provided with excellent road conditions, availability of road lorries and refrigerated storage fitted at close distance to the airport and relatively near to the ocean port. In addition, the flower custom clearance is traditionally done while the cargo is still on its way in the air. This procedure is well known by Miami authorities who could apply the same procedure to our case, speeding up the process even more.

Miami's access channel is 1Km long and the port is fitted with 7 gantry cranes with capacity of 50T with spreader, 70T with hook and beam (figure 4.4.). Furthermore, an additional 3 gantry cranes exist with a capacity of 40T with spreader, 45T with hook and beam to do the handling of containers, with an efficiency of 30 containers per hour. The main cargo figures are approximately. 5,850,000 tons of cargo, 505,000 TEUs and 3,200,000 passengers handled annually. One recognized problem is the restriction on speed in the surrounding coastal inhabited area, but arrangements could be made to increase the speed limit by sailing slightly further offshore during the approach.



Source. Fair Play

Figure 4.4.
Layout of Miami's Port - USA

Therefore, in order to save unnecessary road transport cost, considering that the port offers all required logistics services and the know how of the city authorities to deal with our specific product, Miami's port is the most suitable solution for our case.

4.5.4. Route selection

4.5.4.1. Passage selection: A critical issue in the setting up of the intended service is the correct section of the route, especially in our case, were time is a sensitive element.

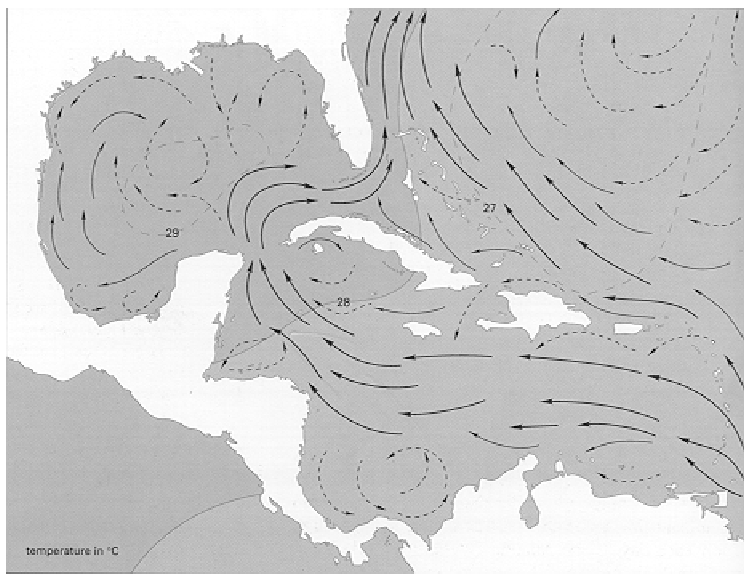
Source. Atlas of the Oceans

Figure 4.5.
Windward Route Santa Marta - Miami

Geographically, going from Santa Marta to Miami there are two options available, either via the Yucatan Channel or via the Windward Passage. The first option takes us through the Caribbean Sea to the sound with Cuba on the east and the Yucatan peninsula to the west. This option is quite convenient because most of the voyage is done on the open sea. It excludes disturbance of navigation due to congested areas.

In addition, the distance between the peninsula and the island offers no restriction to navigation allowing many ships to pass through at the same time.

On the other hand, this area is subjected to rough weather conditions, especially between the months of November and January, when the strong cold winds and rough seas, so called “North”, come from the continental North America posing a danger for navigation and prohibiting transit in that area. Moreover, the critical element to consider on this route is the fact that it is about 120 miles longer compared with the Windward Passage.



Source. Atlas of the Oceans

Figure 4.6.
Predominant currents and winds on the Caribbean Area

The Windward Passage is the name of the route that goes east of Jamaica, passes Cuba on the east, passing through a channel formed by Cuba on the west and Haiti and the Bahamas on the east (figure 4.5.). This Passage has the disadvantage of being transited by many regular cruise ships and recreation boats, giving a special delicate status to the navigation and safety to be observed by the crew. However, the traffic is well organized and the islands form a natural protection barrier, which ensures good weather conditions almost throughout the year, with the exception of occasional hurricanes that strike the east coast of the USA, but it is well monitored by the Rescue Service of the US Coast Guard. During these events the navigation is forbidden for up to a week at a time.

Despite the moderate traffic and the occasional storms, the Windward passage is so far the best option, mainly because the considerable difference in distance, which at a speed of 50 Knots represent a difference of 15% reduction on the transit time, if we compare with the Yucatan passage.

Since the Windward Passage has been selected, there is another consideration to be taken into account: Should we stop to bunker in some Caribbean Island in order to complete the trip?

4.5.4.2. Refueling viability: As expressed previously, our model ship the TSL, has a limited endurance of 500 miles, since the model was conceived to cover distances within the Japanese archipelago.

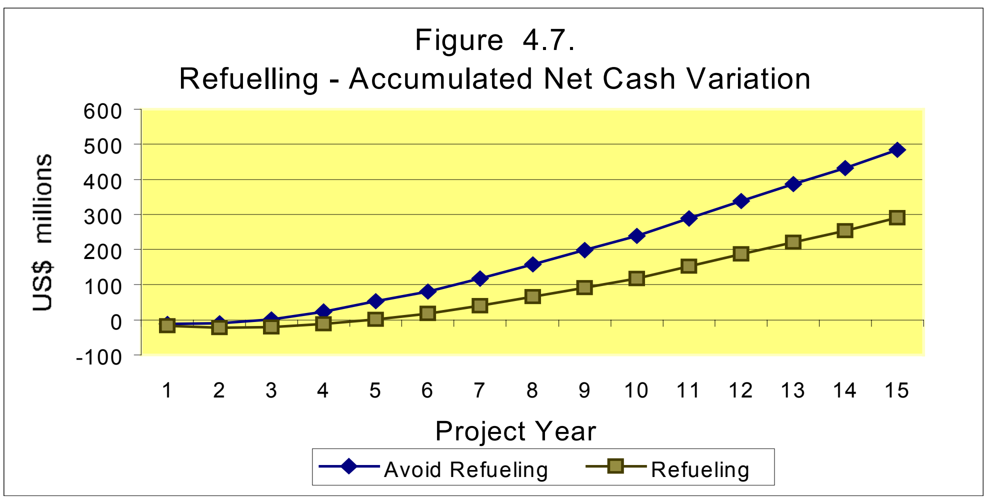
Considering that a straight line navigation form Santa Marta to Miami via the Windward Passage covers 1058 miles, at first sight it clearly suggests that a stop for refueling must be made. This is recommended close to midway trip, in order to improve effectiveness.

There are two possible scenarios. The first one is that the TSL, after departure, would have to stop to be refueled, and then continue with the second half of the leg.

Considering the fuel prices in the Caribbean, the island of Jamaica was selected, since the bunker price of other traditionally tourist locations such as the Cayman Islands and the Bahamas, is tremendously more expensive. Moreover, since

Kingston (Jamaica) is already used by major shipping lines as a hub port it would be interesting to see if further volume development could be gained due to this fact.

The distance from Santa Marta to Kingston is 438 miles and from Kingston to Miami 747 miles. At first sight, it is revealed that there is an increase in the navigated distance of 127 miles, which at constant 50 knots gives us a tremendous time increase of 2 hours 30 minutes per leg, plus the total time in port of about 2 hours per call. It would give us an increase on the round trip time of more than 9 hours.



Source. Hugo Nino

Even for conventional liners, 9 hours increase on a round trip time, represents a serious problem to overcome. In our case, this extra time means that the project cannot be completed at all since it will reduce up to 20% (from 168 to 134) the number of round trips per year, thus the total volumes transported. Most critical is the fact that the IRR of the project could fall 7 % due to a decrease in the total revenue collected, as well as an obvious reduction of cash flow accumulating up to US$ 200 million at the end of the projects life (figure 4.7.). This economic consideration makes the refueling proposition just too expensive to be viable.

The second scenario considers the TSL sailing all the way without stopping. This case represents another problem since the ship is designed for ranges of up to 500 miles, and the real distance here is a little more that double. Considering that the ship consumes 0.352 ton/mile at a constant speed of 50 knots, it would need 190 tons more fuel capacity to complete the second half of the journey.

The question to be asked then is how do we get this extra space for fuel? We could always consider ordering the ship with more fuel capacity, right from the first stages of the new building process, leaving the problem to the naval architects. However, since the TSL is a prototype and we are studying the commercial feasibility of the ship as it is, we have to deal with this issue adjusting the transport solution to our reality, in other words to sacrifice cargo space to transport fuel.

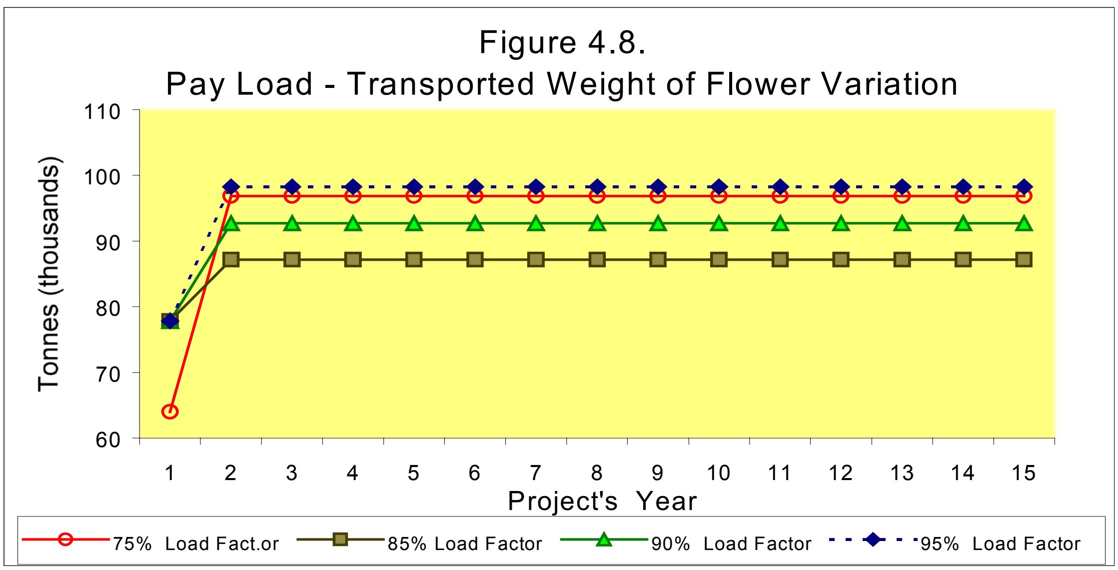
In the first stages of the project, high volumes are not to be reached since it is a completely new service and shippers would be reluctant to switch to a new unexplored operator. Considering a pessimistic 30% load factor in the first year, the space to carry the extra 200 tons of fuel onboard would be no problem with more than 600 tons available.

But for the later stages of the project when higher market participation is expected, we have to find a limit load factor that would allow us to transport the 200 extra tons of fuel at all times. The LF that copes with this characteristic is 75%. This figure is quite extreme if we consider that we are sacrificing 25% of the total revenues corresponding to freight.

We can conclude that if we establish the liner service, always stopping to refuel at midway, we will have a reduction of close to US$ 200 millions on our accumulated cash flow (best scenario possible). Not stopping represents a sacrifice of cargo space which however would be more profitable than stopping.

Even if we have to stop to refuel at some stage of the project's life, we must decide which is the optimum pay load capacity that will return the highest profitability.

4.5.5. Setting ship's optimum payload: If we consider four different scenarios, all of them with a low load factor in the first year but increasing to most desired constant percentages from the second year on, we could compare the profitability and the total actual cargo carried during each year.

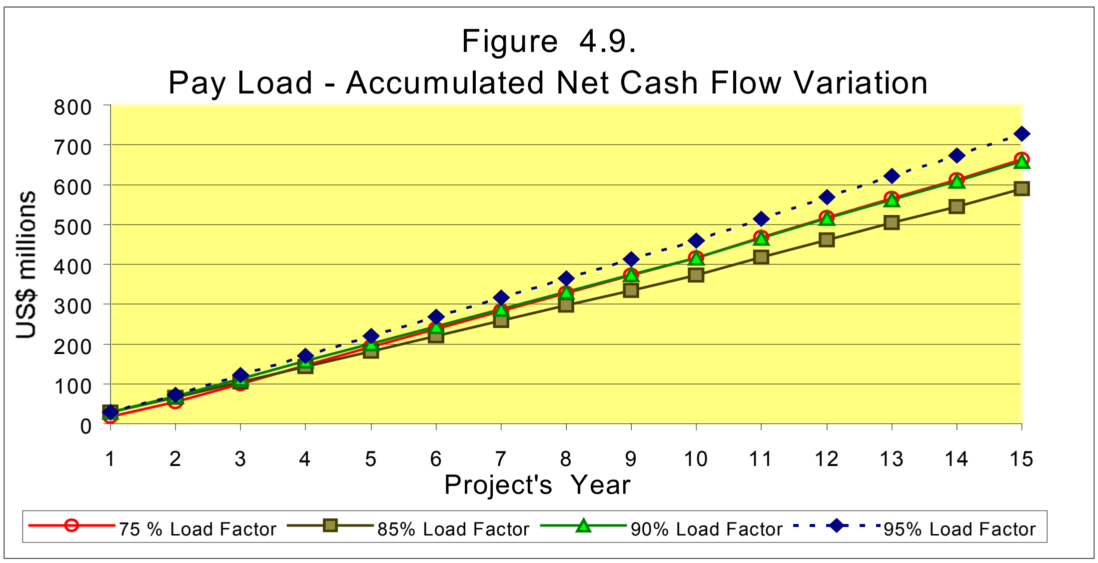


Source. Hugo Nino

Figure 4.8. shows us how an increase of load factor is not necessarily reflected in the rise of total actual weight transported per year. Here we can see that even with an increase of the load factor of 10 % the total amount of flower transported drops a little more that 10,000 tons per year. This phenomenon is easily explained if we consider the fact that, since the previously available space for extra fuel is occupied by cargo, the TSL will have to stop midway to refuel to continue with the second half of the journey. This stop will affect enormously the performance of the project

dropping to 134 the number of voyages per year, and so, proportionally the volumes transported per year.

Increasing even further the payload to 90% still does not give a higher figure. Only after we reach the extremely optimistic 95% Load Factor do we obtain not only high volumes transported but also higher accumulated net cash. (figure 4.9.)

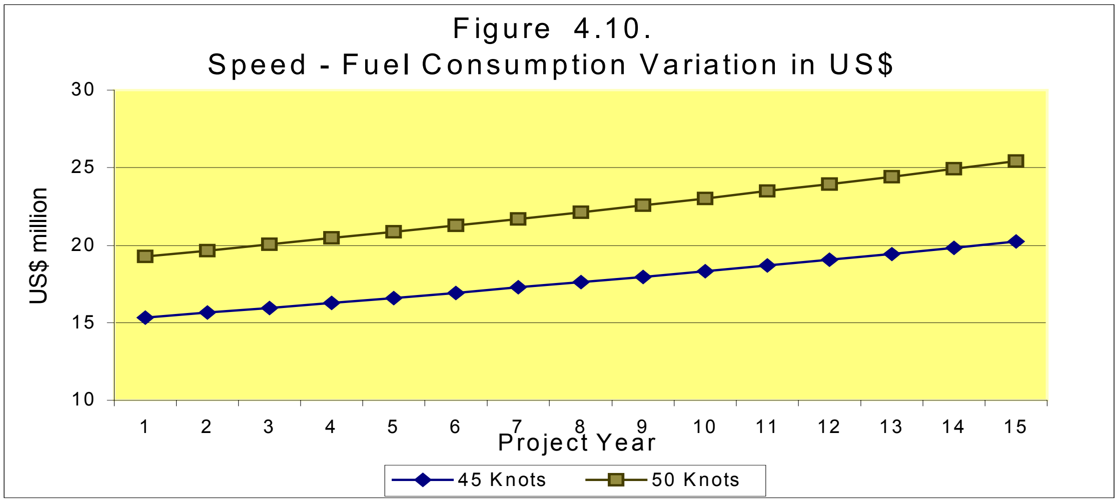


Source: Hugo Nino

In any case, if such high volumes are obtained instead of trying to straighten the conditions of our single ship it means that the market demands an additional ship.

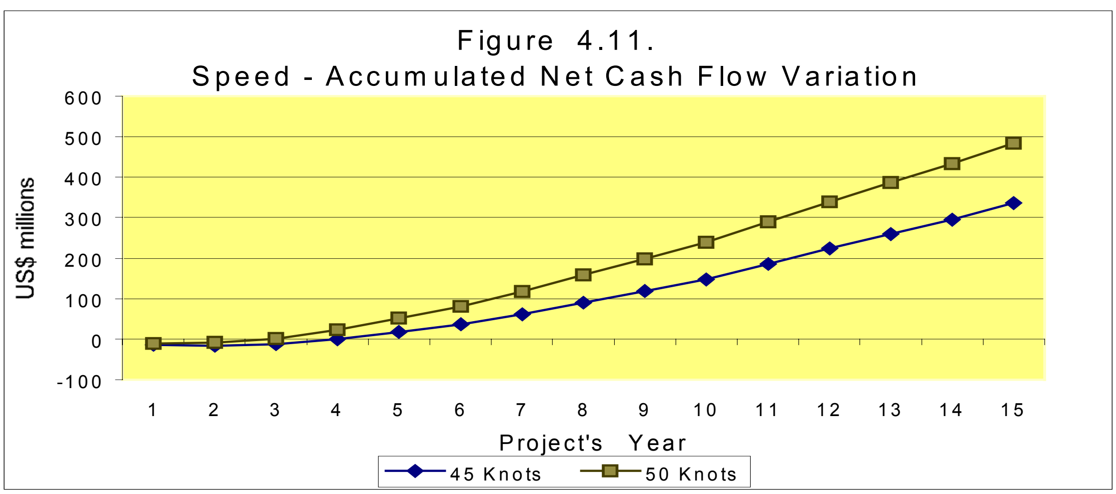
As a consequence we decided that the best option would be to fix a limit to the load factor of the ship at 75% (750 tons pay load) using the remaining space for fuel, but with 168 round trips per year providing 48 hour departure frequency, which is the main characteristic of the line. This represents higher overall transported volumes per year.

4.5.6. Speed: Although the designed cruising speed of the TSL is 50 Knots, we must find out how sensitive the project is to variations in speed. It is well known that a little reduction on speed could be reflected in great voyage costs saving, which is the case in our particular service.



Source: Hugo Nino

As shown in figure 4.10. we can save close to US$ 5 million per year only by reducing the speed by 5 knots. However, an even smaller reduction of speed to even 49 knots would add 30 minutes of navigation time.

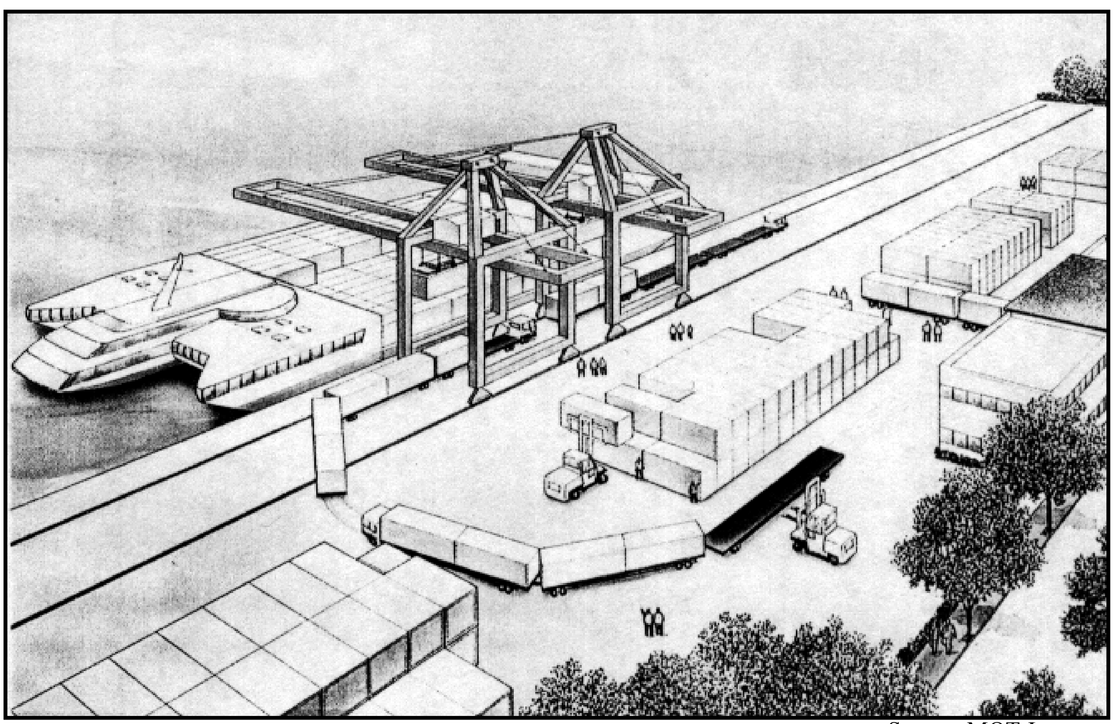


Source: Hugo Nino

Since time in port is very much fixed, this variation would be reflected in the total round trip time, forcing the fixed schedule to be changed to wider intervals. Thus a reduction in the volumes transported and a tremendous reduction of the accumulated net cash would result. (figure 4.11.)

We may conclude that the project then, is extremely sensitive to speed reductions, so the cost on R&M must be considerably high if we are to maintain the hull in optimal conditions to obtain the designed cruising speed at all times.

4.5.7. Cargo Handling: With an ideal load factor of 75%, the TSL would be able to carry a total of 56 fully stuffed H40' refrigerated containers on board. This amount must be discharged and reloaded at the time available to meet the ideal 48 hours fixed schedule departure frequency, which is the main feature of our service.



Source. MOT Japan

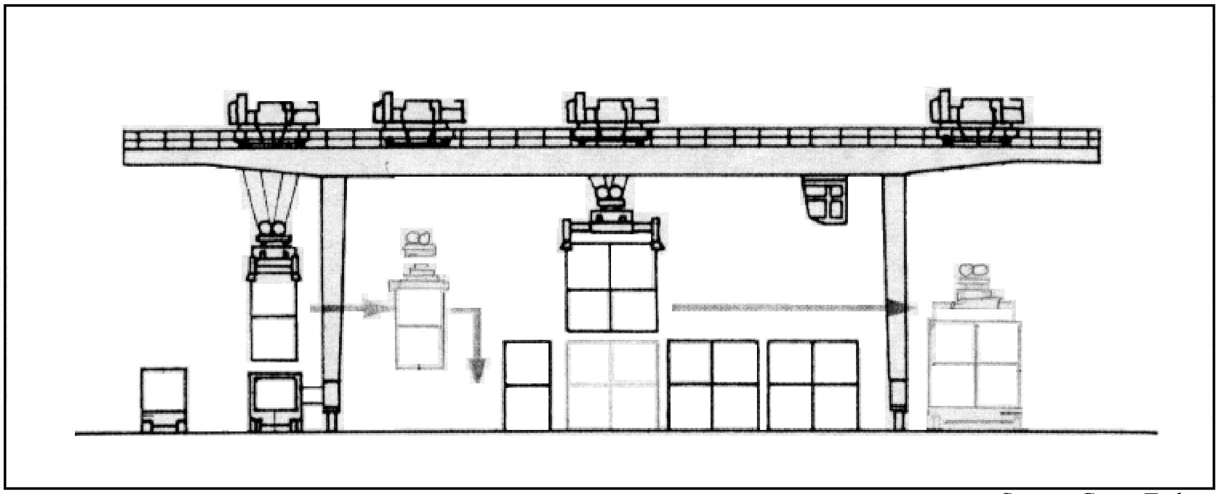
Figure 4.12.
Physical Distribution System for TSL

Cruising at 50 knots we will have a total of 5 hours 35 minutes for port activities. Two of those hours are already designated to time in access canals and time spent by authorities, leaving only 3 hours 35 minutes per round trip to complete the entire loading and discharging process. A rate of 62 containers lifted per hour is required.
A terminal yard operation study was conducted in 1995, by the Port and Harbor Research Institute and the Japan Cargo Handling Research Institute, to investigate suitable port handling techniques to apply to the TSL.

As a result of that, several combinations between service gantry cranes and yard operations were considered combining transfer capabilities of individual crane designs and the rate of cargo flow within the terminal. At that time the researchers were looking for the movement of 150 TEUs per hour, a total of 300 movements or a container movement every 12 seconds.

Obviously, such a speed is very hard to cope with but several innovative designs were created. (figure 4.12.). The most interesting and suitable for our case are the ones that proposed to lift more than one container per movement, grouping together the containers in so called blocks. Two options where set up, the first of which was utilizing only single road chassis to transport each box from the gate to the gantry crane where the blocking would take place (most likely the quay side). This system proved to be too expensive due to the high investment to reach a sizeable pool of road chassis and several gantry cranes to maintain the necessary transfer cycle.

The second one considers the transport of single containers to the terminal yard, then to prepare blocks of four containers using a yard gantry crane (transfer crane), which would fit them on special yard chassis designed to transport 4 containers up to the wharf where the service gantry crane would lift them to be loaded. (figure 4.13.). The same chassis would be used for the unloading operations 8 (see figure of gantry crane). This system is more reliable because by blocking containers in the terminal yard the container flow to and from the ship is not disturbed. Moreover, only a limited number of yard chassis, a yard transfer gantry crane and a service gantry crane need to be purchased (figure 4.14.).



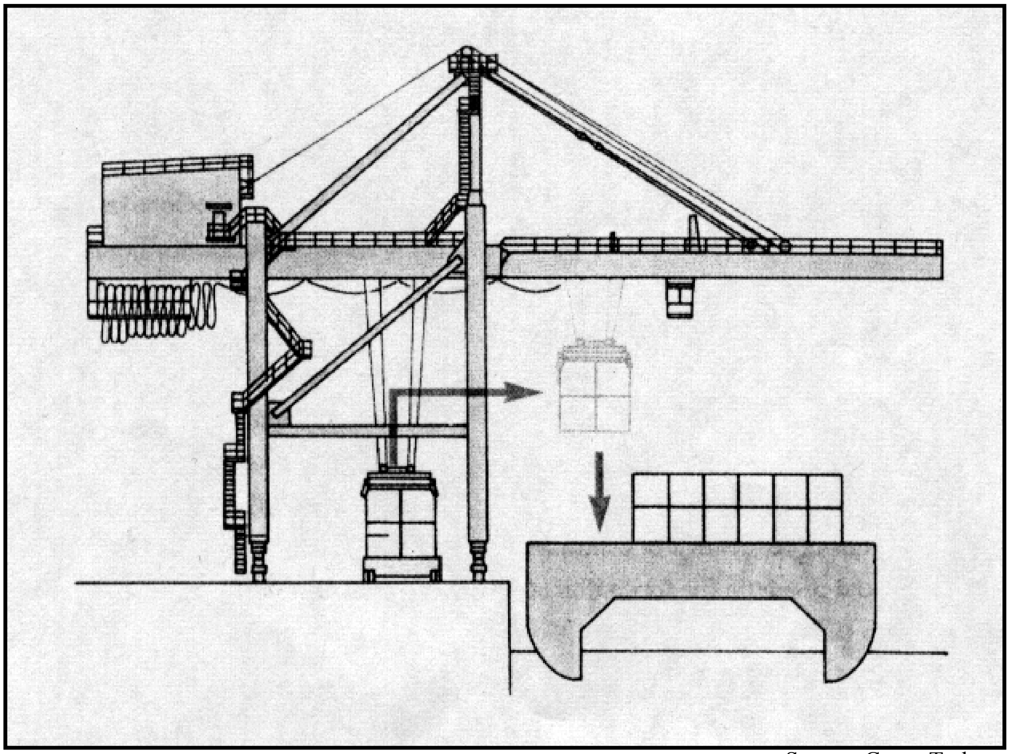
Source. Cargo Today

Figure 4.13.
Transfer blocking containers

Blocking 4 containers together represents a complicated technical approach, which would require re-designing container fitting and fastening devices to meet the need to join the boxes not only vertically but also horizontally. This system was named the block/unblock device (B/UB). In addition, there would be a need to use highly rated spreaders on both the service and transfer cranes.

Although all the above mentioned systems are well suited for the high volumes transported and more than one vessel being serviced per day, both models are capital intensive on the port side, money which may be difficult to obtain in the first stages of the project.

In our particular case the volumes are not so great and the ports would service the ship for a very limited period every other day, so such investment is not justifiable.



Source. Cargo Today

Figure 4.14.
Four Container Lift Gantry Crane

Those apparent disadvantages are in fact advantageous to find a suitable solution for our case. The maximum total container weight would be 14,450.oo Kg, roughly speaking 14.5 tons. This figure gives us a container utilization ratio of only 44%. Taking into consideration that the existing gantry cranes in Miami's port can lift up to 50T (with spreader arrangement), in theory it would be possible for the crane to lift two fully loaded H 40' containers at the same time. Since their combined total weight is 42% less than the crane's admissible safe working load.

The procedure would start when the road chassis gets to the port gate with the laden container. The truck would have to go to the terminal yard where a reachstacker contchamp would pick it up to transfer it to the storage position. (picture 4.1.).

Source. Kalmar

Picture 4.1.
KALMAR, reachstacker contchamp

Once the first container is placed in the desired position, the driver would have to go for a second container and the new one would be placed on top of the first one, however, between them a twistlock would have to be fitted. An assistant would have to be nearby to secure the B/UB device, then the two laden containers will form a block.

Once the TSL arrives at the wharf, all blocks would have to be moved to the quayside. Once again the reachstacker would have to grab the block to be fitted on top of a terminal tractor. Then, the tractor would take the block to be picked up by the gantry crane to load the ship.

Source. Kalmar

Picture 4.2.
KALMAR, reachstacker contchamp - Storing at 4th Row

Currently the Swedish firm Kalmar is manufacturing a design of reachstaker model, which is capable of lifting 41 tons at a height of a second row of containers. That is 10 tons more than what our block would weigh. The volume in theory would not be a problem since the block wouldn't be transported long distances, only to the point to reach the terminal tractor (picture 4.2.).

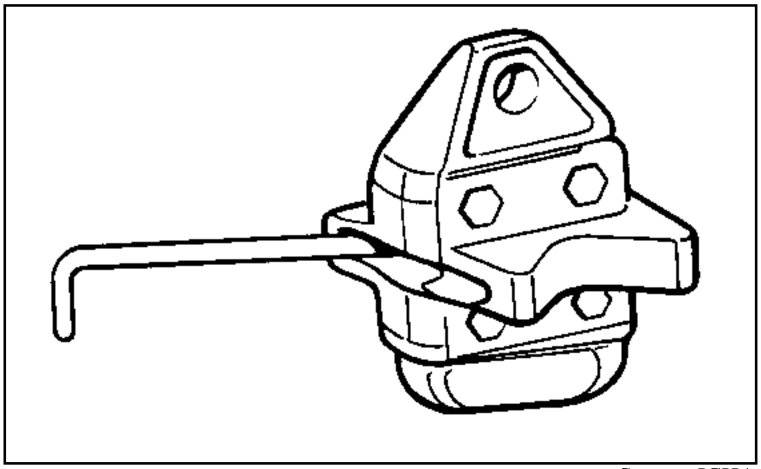
The same firm produces a terminal tractor, the Magnum 32 TT - 120, with a capacity to carry 32 tons. That is 6 tons in excess of what our block would weigh. This tractor is highly maneuverable and it is adequate for the block positioning under the crane (picture 4.3.).

Source. Kalmar

Picture 4.3.
KALMAR, Terminal Tractor, Magnum 32 TT - 120

On the gantry crane, there is possibility to improve even further if we consider that most cranes have a capacity of 25 to 30 movements per hour, at a hoisting speed of 4 meters (160 ft) per minute. The time for the container to reach the correct position on board the TSL will be less because the block would not need to be lifted more than 6 meters per movement, half of the current average operation.

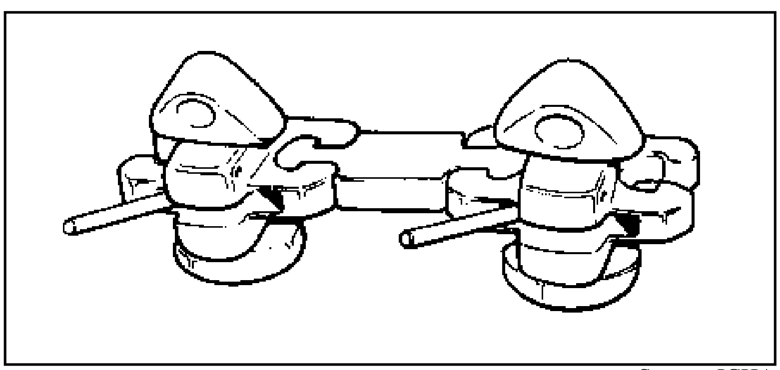
Now we have to also consider whether the design and safe working load of the B/UB is strong enough to resist the weight of the two laden boxes. However, what exactly is needed? We simply need a device that could hold the containers together vertically for the two container blocks and horizontally if we decide to use four container blocks. The reality is that there is production of such devices in the market already, which are the well-known Twistlock for vertical fastening (figure 4.15.). and the Dog Bone Bridge (figure 4.16.). for horizontal connection



Source. ICHA

Figure No. 4.15.
Conventional Twist lock

These elements may not be too fancy but in principle they could perform the job. There is a problem, though, safety wise. Several producers make these elements all over the world, with slightly different designs, but definitively different materials and standards.



Source. ICHA

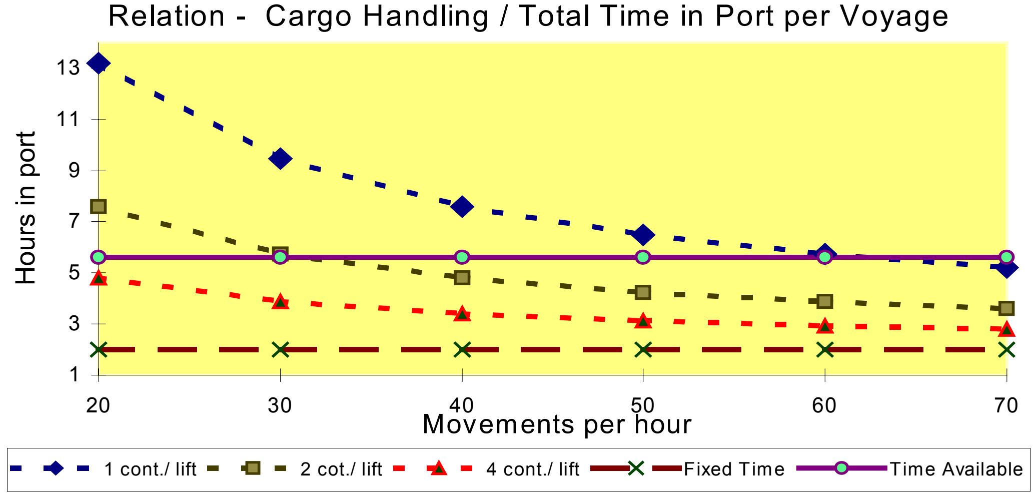
Figure No. 4.16.
Conventional Dog Bone Bridge

Nowadays, twistlocks have been produced that can stand up to 40 tons safety loads, but it is not the standard. We must be very cautious to purchase and use the accurate design.

In a personal interview we referred to Mr. Gary Crook from UNCTAD, in which the cargo handling project was exposed and questioned. He advised that this type of operation is occasionally practiced in the main hub ports in the world such as Rotterdam, Hong Kong and Singapore with excellent results, but with questionable safety implications, since the system works perfectly when there is movement of container stuffed with volume cargo or movements of empty containers. However, it is extremely dangerous to operate containers stuffed with heavy cargo, forcing the gantry cranes to work too close to their safety limits.

The operational volumes in those ports are beyond the scope of our project. For them, the characteristics of the transported cargo is not relevant, since productivity and tariffs are based on the container box as such. Nevertheless, in our case the maximum container weight is fixed, the characteristics of the cargo well known and the freight structure different.

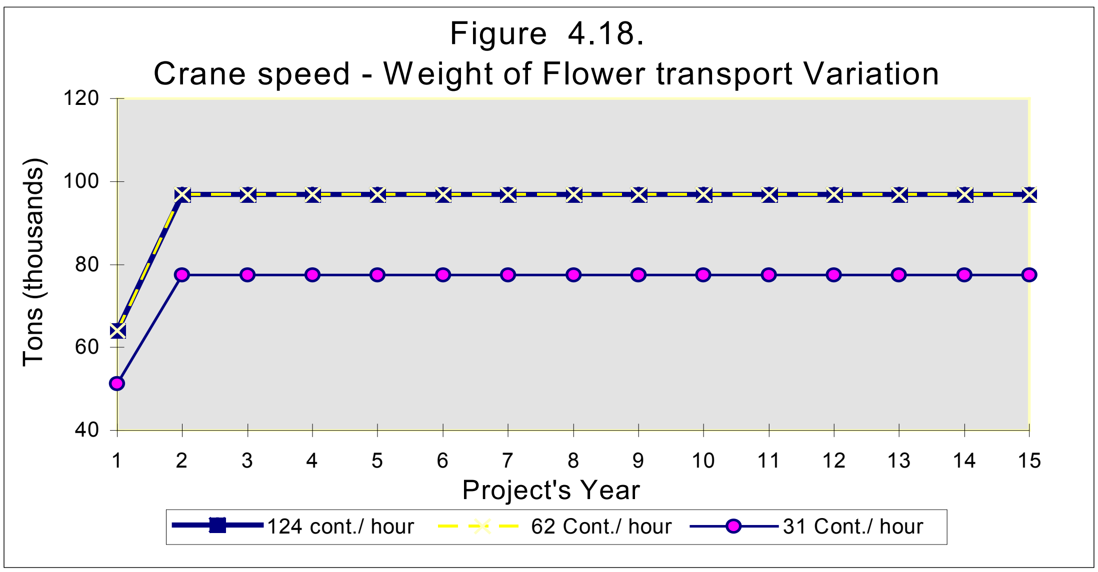
Figure 4.17.
Relation - Cargo Handling / Total Time in Port per Voyage



Source. Hugo Nino

Technically, the two container block seems to be the best solution for our case. Most of the existing equipment could be used reducing the amount on the port investments, transforming our service into an attractive project, even for the terminal operators.

By blocking containers, we will be able to double the number of movements per hour without changing the characteristics of the gantry cranes. To meet our allowed time in port, we need an operational rate of at least 62 movements of a single container per hour, or 31 movements per hour of two containers blocked together (figure 4.17.).



Source. Hugo NIno

By blocking containers we obtain a decrease in the operation time in port. Thus, we will allow more time to complete the navigation. Operationally it does not make much difference if we move blocks of two or four containers. As seen in figure 4.18. we will not transport more tons of cargo by increasing the number of movements further than 62 per hour (note that the lines for 124 and 62 overlaps in the graph). The time available allows the 62 movements of single containers, 31 double blocked container movements or 15 four-blocked container movements. At this point if we want to increase the number of movements by means of more cranes serving the TSL or by investing in four-blocking devices, the investment in new port equipment would be greater than the results gained.

The only way to carry more volumes and so, to collect more revenue, is to increase transported volumes. This could be achieved by increasing the number of round trips per year or by putting into operation another TSL, in the same route. It is very difficult to further increase the number of round trips per year since we are already cruising at an extremely high speed and port facilities are not ready yet to serve the ship faster.

We can conclude that a project with a single TSL is mature from the start. But, if the need to move greater volumes arises, we will have to increase the number of ships on the route.

Additionally, it is relevant to mention that by blocking and lifting 4 containers, we would gain some extra time in port that would allow us to reduce our cruising speed to 48 knots without major variation in the number of round trips per year, and also saving up to US$ 1.400.000 per year on fuel cost. However, if the volumes are moderate the savings in fuel do not compensate the enormous investment in equipment on the shore side.

4.6. Marketing strategy.

As mentioned previously the TSL service's main characteristic is an extremely low transit time and high frequency on a fixed schedule bases. The service is set up to offer reliable departures every 48 hours crossing the Caribbean Sea and the Antilles in a little more that 21 hours. Conventional container vessels do the same route in more than two days.

Although providing an excellent alternative to conventional shippers, the obvious conclusion would be to adopt a differentiation strategy competing with the established regular liners to capture a piece of the already competitive tight market. By differentiating the product, the company could set a higher freight. Following the fast ferry industry, we could invest in advertising the advantages of the short time of the crossing embracing expensive publicity campaigns to capture shippers and consignees attention. This could be the first impression, but in fact I believe the strategy should be just the opposite.

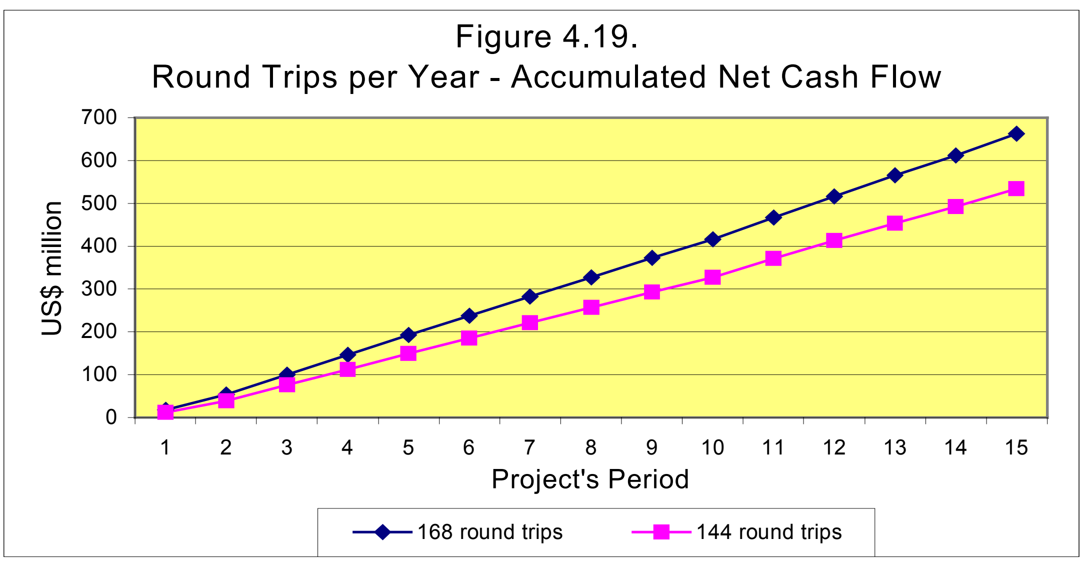
Instead of embracing a different campaign the TSL service has to enter the freight war, not against liner companies which are so used to commit for an extra dollar on long term contracts, but against an even stronger competitor, the air industry. Therefore, the strategy must be to offer a lower freight than the air counterpart. Combining this with the optimal characteristics of the service it would be attractive enough to transfer air shippers to the TSL service.

Considering sea transport figures, the carriage of 200,000 tons of cargo per year is an almost negligible amount. It may not even be subject to much attention if we bear in mind that the latest Maersk Container ship design has the capacity to carry onboard 7,060 containers for a DWT of 104,696 tons. But the same amount in the air industry could mean bankruptcy for more than one established air cargo carrier.

The marketing strategy should be directed then to find an adequate niche market. This could be a time sensitive cargo with low capital cost involved so it would not make much difference to spend an extra day or two being transported by sea. On the Colombian side, flowers make the perfect commodity to be engaged with since they feature large volumes per annum, low capital cost and are a perishable, time sensitive product. On the USA side there are several commodities that fulfill those requirements, meat (a little too heavy), pharmaceuticals (a little too expensive), electronics, clothing and computers.

Lower freight and reliability are then the key elements to capture air shippers attention and volumes.

It could be also possible that in order to offer a service fitted to real logistics and just in time needs, the service could be arranged to perform three round trips per week. The service frequency then, would still offer departures every 48 hours, but leaving one spare day per week to carryout turbine and waterjet maintenance routine. The total number of trips per year would decrease to 144 per year, but as seen in figure 4.19 . the profit range ceiling will still remain acceptable.



Source:Hugo Nino

By offering a fixed date departure three times per week it is expected that the public will welcome effusively this idea. The concept is rational since this scheduling procedure meets with real product distribution logistic procedures.

4.7. Balance of trade

Colombian total imports from Florida rise to US$2.35 billion, representing 2 % of the total imports. This amount places Colombia as Florida's second export market and represents 8% of total Florida exports. Moreover, from Colombia comes 5% of Florida's total imports adding up to US$1.3 billion, placing Colombia as the sixth source of Florida's imports with a 5% share.

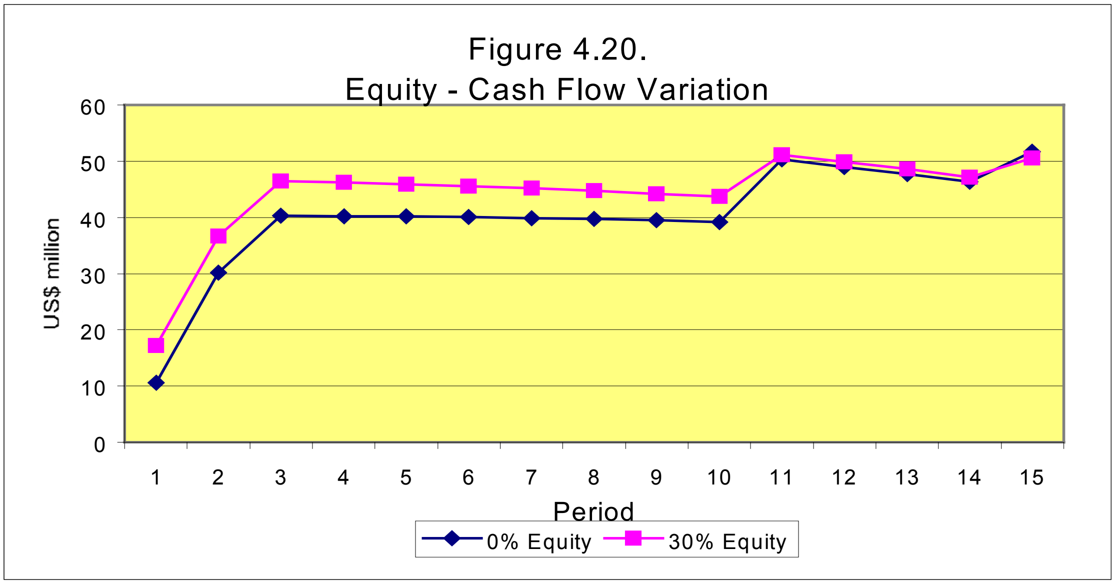
According to the Colombian trade bureau, Colombia alone accounts for over 7% of Florida's US$ 52.1 billion in trade and ranks as its third trading partner.

Because of Colombia's tropical location most of the offered products are agricultural making the top five imported products from Colombia cut flowers, coal, coffee, textiles and bananas. However, sea food and vegetable trade is increasingly growing.

As we can see, the trade is very intensive between Florida and Colombia, especially electronics, chemicals, perishable products and auto parts are imported by Colombia. These market conditions are optimal for the further development of the TSL service on this route.

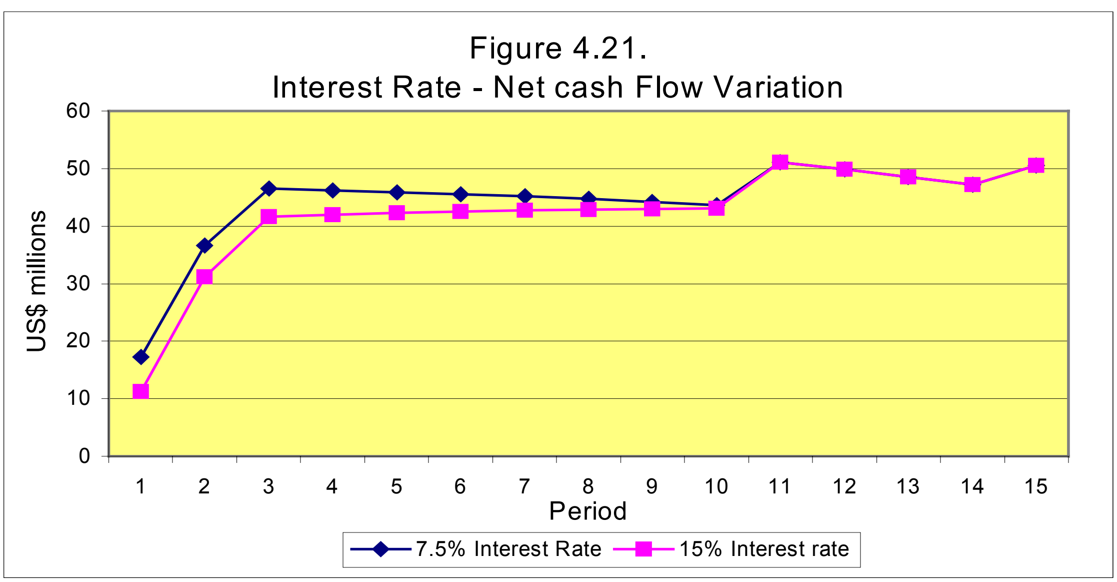
4.8. Sensitivity analysis.

Now that we have considered several possibilities on the establishment and conclusion of the transport project, it is time to analyze how external financial and technical factors could affect its performance and profitability.



Source: Hugo Nino

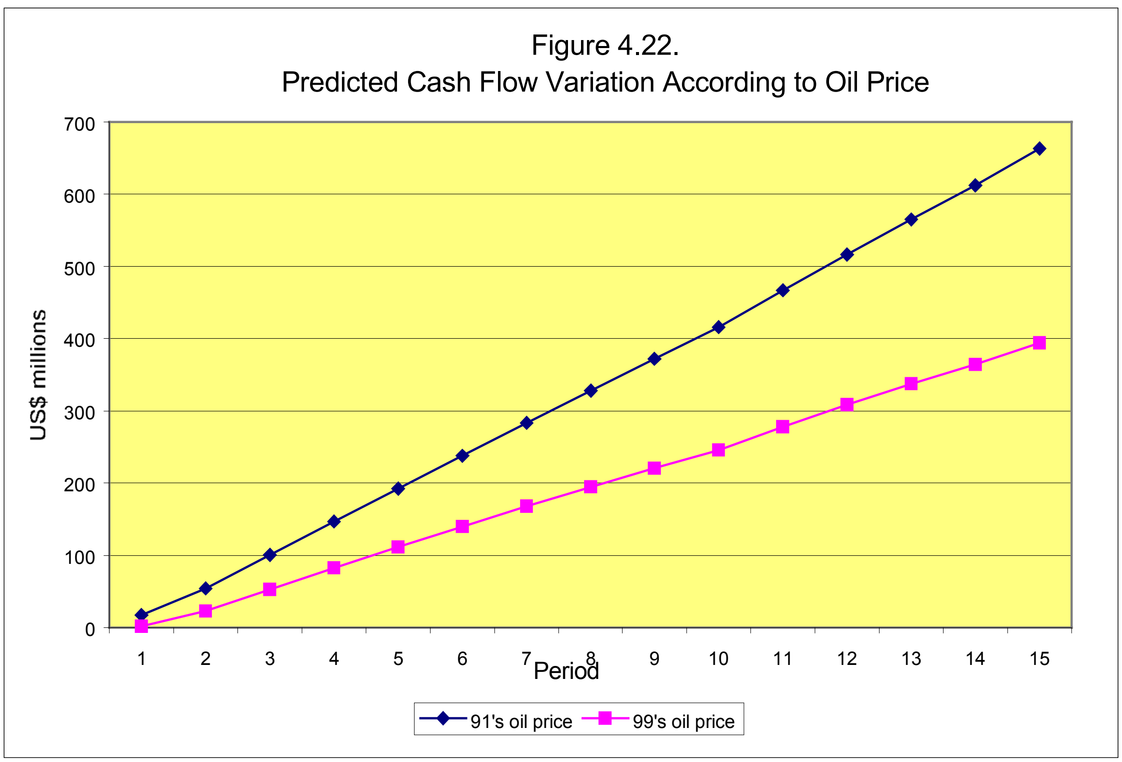
4.8.1. Equity: The project is quite sensitive to shareholders' investment, especially in the first periods when the loan has to be paid, as we can see from figure 4.20. By going from 0% to 30% equity share of the project, the amount of net cash movement increases up to US$ 50 million on the final accumulated. Also we can see a substantial reduction in the early years.



Source. Hugo Nino

4.8.2. Interest rate: Graphic No. 4.21 shows how, with a doubling of the initially considered interest rate we obtain a variation in the cash flows that could reach an amount close to US$ 5 million in period 3, but its importance is clearly reduced as we advance in the debt payments.

4.8.3. Fuel price: Contrary to the previously analyzed cases, the TSL transport project is extremely sensitive to the market oil price. Hereunder in figure 4.22 we can appreciate how, if we use the average market oil price in 1991 during the Gulf war, we clearly identify the enormous difference in the accumulated cash flow of the project throughout its life.



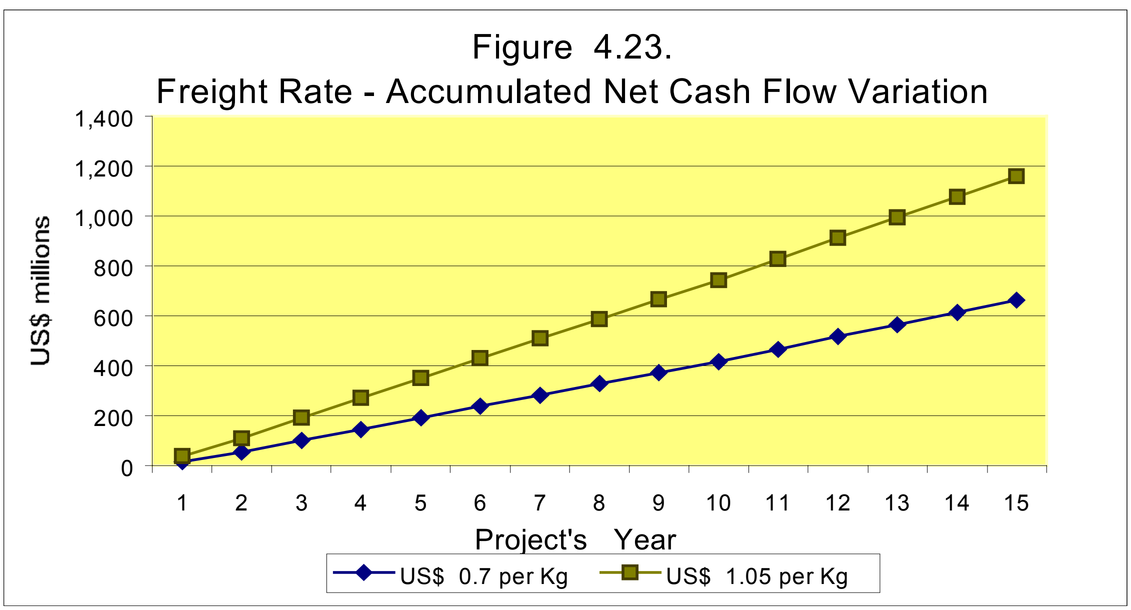
Source. Hugo Nino

This substantial deficit in the cash flow makes the project unattractive for investors, due to a reduction in the internal rate of return of more than 10%.

It is important to clarify that the calculation was made about the influence of the oil price on the bunker costs only. But in reality, the variation would increase the price on the port services and wages also making the increase on costs even greater.

4.8.4. Freight rate: This is a very important and critical issue to ensure the life of the project. Once the freight rates touch the critical break even point it is quite difficult to maintain shareholders' confidence. This could be the case if we face a competitive freight market not only on the ocean side but also with the air industry that would force us to lower the rates to limit values.

Although the freight rate definitely would be set up by the market trend, hereafter we can see the considerable sensitivity of the project to even small changes. 40 cents/kg could make a difference of US$ 400 million in accumulated cash flow. Moreover, it could represent a variation of more than 20 % on the project's internal rate of return.



Source Hugo Nino

If we consider an initial freight rate to be set at a competitive 80% of the air transport, the expected profitability could rise enormously, to place the project with an internal rate of return of more that 55 %. But this figure is extremely uncertain, subject to various risks and situations to consider (figure 4.23.)

4.9. Risk analysis

The project could be affected by a wide variety of facts. Among those we have:

4.9.1. **Political situation:** Without any hesitation we can refer to the current political situation of Colombia as an imperative threat for the possible future establishment of our transport project.

For the past three decades the country has been involved in a civil war, worsened by the proliferation of illicit production of drugs. During the 80s, the country's economy was maintained due to extraordinary quantities of money laundering coming from the profitable smuggling activity. A sudden and unplanned, complete opening of the economy adopted in 1991 led to many legally established industries' bankruptcy, generating 25% unemployment.

Recently, strengthening and constant attack of the insurgent groups to industry locations and oil pipelines and kidnapping of entrepreneurs have left the country with a climate of uncertainty for external investors to place their resources.

In our particular case, this environment of turmoil affects the project, since it is quite possible that once the service is established, it would be the target of smugglers trying to use it as a tool to introduce illicit products to the USA.

Furthermore, USA courts impose extremely severe fines to ship owners and related companies when containers or any other cargo is found with narcotics trying to enter the country. Moreover, just one detention by the Coast Guard could mean millions in losses due to the nature of the cargo transported and the discrediting of the service.

Normally, the United States imposes sanctions on South American countries that do not follow its commercial policies. This has been the case of Colombian products that were sanctioned by raising the import tariffs in 1996, making it impossible to compete in the market. The situation now is normal but any sanction or bounding to the Colombian flower industry would be reflected on the project's performance. To prevent this scenario, considerable sums have to be spent on guard services with specialized companies. Even though this measure is taken, the risk still remains.

4.9.2. Competition and partnership: The project as such seems quite profitable and market secure since we already identify a niche market to capture, even though the freight war against the air transport industry is forecasted to be fierce.

In the last 4 years the air industry experienced a recovery in general terms. Although the industry had to lower the fares, an extraordinary consumption growth of about 8% per year has leveled the balance. IATA reported that most of its associated companies would end up with positive results, despite the Asian crisis.

In addition, we can attribute the positive results to rational management of resources and a reduction of costs as a result of mergers and alliances.

Nowadays the air industry is quite strong and well positioned and is willing to remain as such. A potential competitor not only on the cargo side but possibly also on the passenger segment would be combated strongly.

Dr. Cushing is a pioneer on maritime transport innovations on the ship as well as on transport in general. When questioned about the project, he expressed his concern on how strongly the air industry would react to this new threat, pointing out that well known and financially strong airlines and liners are used to embark on freight reductions to capture lost volumes, even to the break even point and some times less than that.

It is then expected for the project to face strong competition by the shipping and air industries based on freight reductions. An effective way to overcome this circumstance is to establish long term transport contracts, negotiating competitive freights with shippers on a long term basis.

Another effective way to ensure the service permanence is to select the right partner to initiate the project together from the very beginning. In our case, that partner could be the Colombian flower industry itself, or even the traditional air cargo companies.

In the first case it is advantageous for the flower industry to secure a cheap means of transport for its products and in the second case it would be a way to smoothen competition to regulate the market. In any case, the risk of strong competition remains.

4.9.3. Technology: Especially on new developed transport modes there is a risk for new improved designs to come to the market rapidly. Boosted by profitable results it is expected that the TSL designed hull and engine would be improved to reduce the fuel consumption even further.

Automation could reduce crew even further, especially on this short route, thus reducing the operation cost considerably.

4.9.4. Volumes: As seen in the previous chapter, the transport of flowers from Colombia to the USA is intensive, not only in volumes but in value, representing an important share of Colombian total exports. In 1997 a total of 146,000 tons of flowers were exported, 80% of those to the USA for a total of 117,000 tons.

Based on our calculations, we can conclude that for the project to meet our expectations it is necessary to transport as much as 97,000 tons of flowers per year, meaning that we must transport at least 85% of the available cargo. This is indeed an extreme situation, especially if we consider that any change in the conditions on the consumer market can lead to serious revenue reductions.

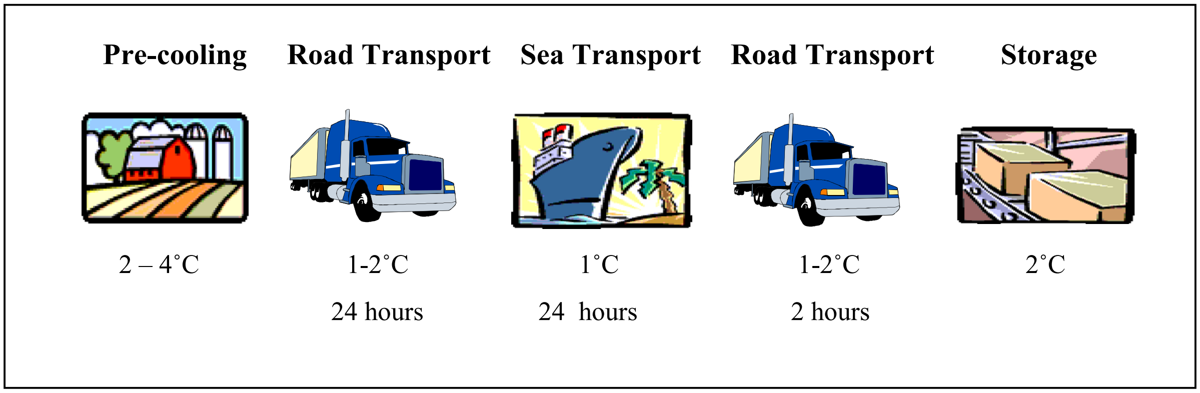
Then in our case the traditional "20–80 rule", is modified to be converted to a "1-99!" relation, extremely difficult to deal with, since eventually the service user may be in control of the freight, if we take into account that he has an alternative but our service does not.

There is no alternative commodity with similar characteristics to be transported from Colombia to the USA.

4.10. Transport analysis

For our transport solution we considered the same packing box and the amount of flowers as for traditional exports. It is already a standard and it could be expensive to change some or all the specifications. Moreover, this box size fits our need since it gives enough space inside the container to maintain the air flow. In addition, the transport temperatures are the same as used in the air industry, since those are the optimal conditions to prolong the product's life.

The main differences between the conventional flower transport; and the use of a new transport vehicle, the TSL, are the increase on the land leg transit time, and the utilization of sea port facilities to load, unload and for storage.



Source: Hugo Nino

Figure No. 4.24.
Principal Characteristics of the TSL Flower Transport

The first case is influenced by the total distance of 802 Km from the production area to the port facilities. Although not far away, the transit time is calculated to be 24 hours considering the hilly road that the truck must transit on, crossing the Andes Mountains on very dangerous passages. This limits the speed to an average of 45 Km/h, plus possible time loss due to port congestion. The second difference is clearly influenced by the modification of port operations to adjust to the new service needs, and modifications that could become costly.

Most important is the fact that the combined craft, technical and economical considerations of the service, under favorable external conditions, clearly shows that the project should be viable.

The main advantage is a time reduction by 40% compared with the service offered by conventional container ships, plus a reduction of the current air fare down to 70% (table No. 4.5.).

Comparison Freight and Transit Time							
		Long Leg		Land Leg		Total	
	Freight Reduction	Freight US$/ton	Time Hours	Freight US$/ton	Time Hours	Freight US$/ton	Time Hours
Airplane	100%	1750	4	670	3	2420	7
Techno Super Liner	80%	1400	24	160	24	1560	48
	70%	1230	24	160	24	1390	48
Conventional Ship	20%	350	50	160	24	510	74

Source: Hugo Nino

Table No 4.5.
Comparison of Different Transport Modes Freight and Time.

In addition, the transit time is placed within the permissible limits of flower conservation under refrigerated conditions, which is one week for carnations and 4 days for roses, still offering a fresh product to the market.

Indeed, after having an in depth overview of our niche market, the transport needs, the possible alternative solution and expected barriers, we now need to express the relevant recommendations for the successful completion of the project.

Chapter five

Recommendations and Conclusions

In the previous chapters a detailed analysis was conducted on the viability to implement the transport of flower from Colombia to the USA using the Japanese high speed pure freight craft called the Techno-Superliner. A description and overview of the ship itself was carried out, pointing to the main technical developments, scientific background and historical developments. Then, the chosen market was analyzed including the Colombian flower sector's competitive advantages and current transport characteristics.

Based on updated information, calculations were performed to show possible investors the worst and best financial scenarios. These calculations showed an affirmative viability to conduct the project, but restricted to external influence, those factors that could altogether impede the implementation of the proposed line.

The project is highly sensitive to gearing, not only on the profitability results, but also especially for the securing of finance. It is advisable to actively involve the participation of investors to gear the project accordingly to make it attractive for banks to share the high risk involved. Some industry perhaps may be willing to invest in the project. On the Colombian side a good partner would be found in the flower growers. Although it is not their core activity they may be willing to invest in this venture if the adequate return can be achieved. The advantages would be enormous if we consider that it could result in considerable additional profit in the trade, not to mention the establishment of a revolutionary and completely new mode of sea transport that could mean expansion of their trade areas.

On the US side, freight forwarders, ports and even shipping companies could be called to join the enterprise, providing a secure market place for the service. Hence, banks would feel more comfortable and permissible on the loan terms and conditions.

Another source of finance to ease the projects gearing could be the shipyard itself. By providing favourable financing conditions or even sharing part of the investment, the yard could promote ordering of more ships, with consequent advantages for the economy of scale. As a consequence, reducing the price of new-buildings and so boosting the Japanese shipbuilding industry to another profitable segment, moreover, promoting further developments on technology that would place the Japanese industry in a competitive advantage against other shipbuilding nations.

For the successful implementation of this transport project it is also recommended that close relations be developed between port authorities and operators. It is vital to establish the suitable political connections to promote the legislative adjustment on both ends. Since this transport solution is completely new, operators must pursue the facilitation of customs clearance, permission of fast and safe port approach, plus further investment in specialised cargo handling and automatic mooring equipment if the service becomes popular and additional new buildings and line establishments are to be established.

Currently there is a high-speed sea service between Miami and Nassau with a capacity of 900 passengers and 242 cars, carrying unattended cargo exploiting the freight capability advantages of the latest generation of giant Cats. This service has been a pioneer on the fast cargo transport in Miami and special speed concessions have already been made. The same regulation could perfectly meet the TSL service conditions.

Although in Chapter Four it was proven that with existing cargo handling technology it could be possible to establish a single ship line, investments on the port side to meet specific TSL service demands to serve several ships are costly but yet are not suitable for any other vessel type.

Those additional equipment acquisitions, if the TSL line services grow, must have to be constructed at the port operators' or port authority's expense. This port development situation requires close contact among the service actors, namely ship owner, ship operator, port authority, port operator, freight forwarders and obviously the financial institutions and private investors.

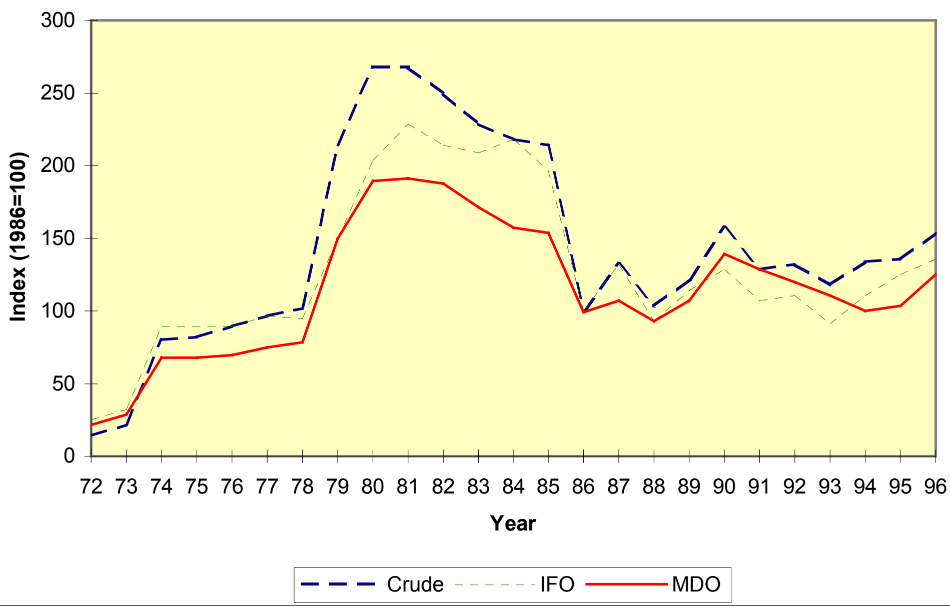
On a similar inter-oceanic high speed sea transport service scheduled to start in 2002, the firm Fast Ship Inc. is planning to offer a regular transatlantic service crossing at a speed of 40 knots for a total transit time of one week or less. Fast Ship has engaged in strategic partnerships with the European port operator MAICO and with J.P. Morgan as the exclusive financial advisor.

Fast Ship Inc. has chosen Philadelphia on the USA side to be the call port. Adequate agreements have been conducted with the Delaware River Port Authority for a substantial investment on new facilities and equipment of US$ 74.8 million. On the EU side the port of Cherbourg in France has been chosen as the right partner; an investment of up to US$ 60 million on new installations and equipment is to be made. Both ports became shareholders on the fast shipping project itself.

Considering the above statements, it is vital for the further development of the TSL service in the Caribbean, the financial compromise between operators and port authorities.

The fast transport of commodities by sea has not been an isolated phenomenon of this decade. Starting in the 70's, not only the private sector but also the military have heavily invested in R&D throughout the years. Several limited cargo capacity prototype designs and models have being fabricated, such as hovercrafts, hydrofoils, planing craft, Small Water Plane Area Twin Hull (SWATH), high performance mono-hulls among others. Although on all the above mentioned projects technical viability is possible, high speed sea freight transport has always been constrained by one factor alone, that is the price of oil.

Figure 5.1.
Relationship between Crude and Bunker Prices



Source: Drewry

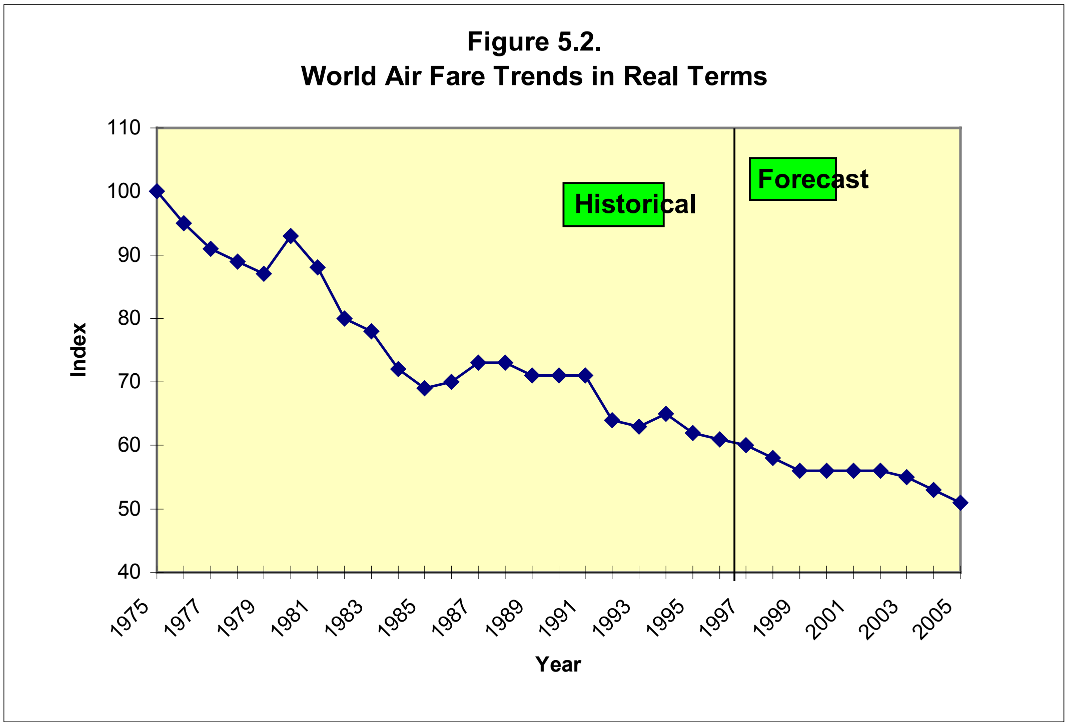
Extremely high fluctuations in the price of oil have prevented investors and conservative ship owners from starting highly risky profit ventures. In figure 5.1. it is clearly shown the strong influence of crude oil on the price of marine fuels.

These fluctuations are sometimes market driven but frequently they have a strong political background, extremely difficult to predict. The intended TSL service is no exception and it is entirely dependent on the stability of the oil prices.

Proof of that sensitivity is the fact that at the beginning of the present research (January/99) the oil prices was set at US$ 11 per barrel with a low down tendency favourable for the implementation of the line. But, after OPEC's decision to establish high production cutbacks the oil price have risen more than 50% in only 7 months. Although even with the current oil price of around US$18 per barrel the project is viable, it is yet unlikely that investors will provide the necessary resources to finance a potentially unstable project.

Therefore, it is recommended to openly advise investors about this sensitive issue. Possible shareholders and financial backs must be aware of this situation to help in establishing a suitable freight rate at an early stage of the project, based on long-term contract basis.

On the other hand, even if the project is viable from the technical and financial point of view it is undoubted that the air industry will represent a fierce competitor. Lately the air industry has experienced changes that reflect its maturity, giving clear signs that it is able to adjust to ever-changing conditions and adverse market situations. As shown in Figure 5.2., the air transport industry has experienced a lowering of fares not only freight-wise but also passenger-wise. This attitude is a response to the over capacity situation faced in the last decade.



Source: IATA

It is important to realize that the trend is a downward one and it is expected that even lower fares will be the future reality.

As a consequence of the above argument, for the implementation of the TSL transport project, it is important to accurately identify niche markets and secure long term contracts that could give stability to the project.

It is also recommended to look for financial support from air carriers, which may be very interested in investing in an alternative transport mode, releasing the project's competitive pressure. A similar case is been identified in the passenger route between Malmö (Sweden) and Copenhagen (Denmark). There, the air company SAS Inc. maintains on a permanent basis a high speed craft service, booked as a regular air route and charged accordingly, but in fact being carried out by sea, at an extremely higher price than its sea competitors.

As seen above, the project is quite sensitive not only to technical but also to social factors. Despite the general difficulties, there are some advantages also to be found along the way.

Although currently facing bankruptcy, Colombia has a modest shipping tradition. The establishment of the Flota Merante Grancolombiana in the 70's marked the first milestone. On a joint effort by Colombia, Ecuador and Venezuela the company strongly entered the world of shipping, with a cargo reserve of 60% the company's life was ensured. Colombian exports grew especially due to prosperity on the coffee trade and the penetration of the Japanese and German markets.

The company achieved an extremely sound market position during the 80's with more than 60 ships, becoming one of the biggest South American fleets. But, with an unplanned, sudden and complete liberalization of the Colombian economy, its merchant fleet collapsed against fierce international competition, which it was not prepared to face efficiently. Low technology ships, corruption and traditional state protectionism contributed to the collapse of the fleet.

Despite this set back, more than 1500 officers, 3000 ratings and 3000 former office staff still have the know how and orientation toward shipping activities. As can be seen personnel-wise, there is a fertile soil to establish a new private transport service adjusted to present market and economic conditions.

Therefore it is recommended to establish the service employing Colombian crews which are also cheap and to recruit experienced marketing and operational personnel to maintain the country's business know how.

The project could have a brilliant start depending on the marketing strategy employed. It is recommended to contract services from well known and experienced marketing companies. It is vital especially on the USA side, where consumers are so used to great openings. It is of major importance that the project in order to reach its maturity, ensures means of gaining continuos growth. Growth that only could be obtainable if new niche markets are penetrated.

In previous chapters, an adjustment of the standard TSL technical characteristics to the service requirements was conducted. This practice had the purpose of evaluating the viability for the utilisation of the original model to the real needs. Therefore several assumptions were made, on the search for the suitable combination of factors. This practice was an academic approach, easily correctable in real life.

As a consequence it is advisable to order the ship in accordance with the line's needs from the earliest stage of the new building process. This is taking into consideration that the ship's efficiency could be greatly improved if the accurate relation between pay load, speed and range is obtained from the design stage.

Despite Colombian political and social instability, it is expected that there will be extraordinary growth of the flower sector in the following years. This trend is definitely supported by the recent purchase of 30 % of the flower production field by DOLE. It is obvious that a direct injection of foreign capital would improve the production condition, market sharing and consequently profitability.

As a consequence, when volumes reach high economies of scale, it is forecasted that the massive use of several TSLs, according to the demand, will provide a suitable solution to further reduce cost, offering a more competitive product and access to different markets.

The alternative solution, using the TSL as the vehicle to move flowers from Colombia to the USA is a project that could revolutionise the overall concept of time sensitive cargo transport. Shippers would have a wider range of opportunities to choose from, selecting the one that would truly offer a better value for money according to the cost of capital of the cargo involved. It is very possible that even a rare adjustment of tariffs could take place, if a drastic switch from air to sea is observed.

Although the project has been conceived for a special and exclusive commodity and route, some other possibilities to use the TSL have been identified. The Caribbean trade with the USA has great potential, as well as the trade between the West Coast of Africa and Europe. The trade between Israel and Germany could also offer the right conditions.

On the other hand the TSL could become the perfect solution to cope with EU policies on Short Sea Shipping, because of the ship's technical characteristics with the real conditions demanded by this modality in the future. Further analysis and calculations must be conducted to explore the viability for the massive use of this design.

It is indisputable that once the first successful attempt to efficiently use the TSL is done, the financial conditions for the following projects would be more favorable and so the venture's profitability.

On the XXI century automated era of shorter distances, electronic trade and immediate communications, the pure freight high speed craft will play a decisive role on the smooth cargo flow of the production chain. The TSL is offering today tomorrow's feeder and short sea shipping.

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