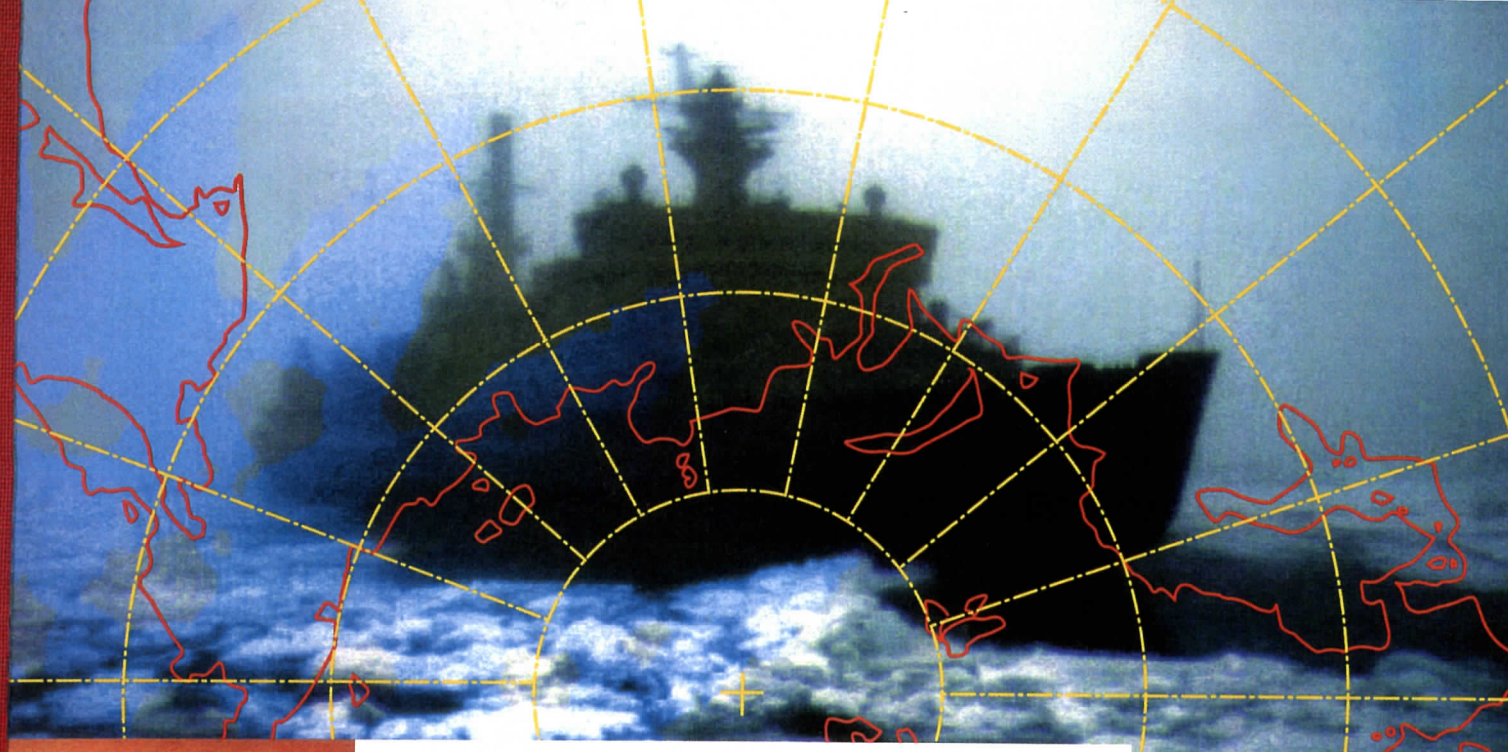

INSROP WORKING PAPER
NO. 15 - 1995, III.07.2

The Potential of the Northern Sea Route for a Regular Cargo Service

Bruce Buchan

INSROP International Northern Sea Route Programme

Central Marine Research & Design Institute, Russia

The Fridtjof Nansen Institute, Norway

Ship and Ocean Foundation, Japan

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By Bruce Buchan, Director

Address:
Polar Shipping Consultants
22 Lovat Lane
London EC3R 8EB
UNITED KINGDOM

Date: 1 August 1995.

Reviewed by:
Nathan Mulherin, Research Physical Scientist, US Army Cold Regions Research & Engineering Laboratory, USA.

What is an INSROP Working Paper and how to handle it:

FOREWORD - INSROP WORKING PAPER

INSROP is a five-year multidisciplinary and multilateral research programme, the main phase of which commenced in June 1993. The three principal cooperating partners are **Central Marine Research & Design Institute (CNIIMF)**, St. Petersburg, Russia; **Ship and Ocean Foundation (SOF)**, Tokyo, Japan; and **Fridtjof Nansen Institute (FNI)**, Lysaker, Norway. The INSROP Secretariat is shared between CNIIMF and FNI and is located at FNI.

INSROP is split into four main projects: 1) Natural Conditions and Ice Navigation; 2) Environmental Factors; 3) Trade and Commercial Shipping Aspects of the NSR; and 4) Political, Legal and Strategic Factors. The aim of INSROP is to build up a knowledge base adequate to provide a foundation for long-term planning and decision-making by state agencies as well as private companies etc., for purposes of promoting rational decisionmaking concerning the use of the Northern Sea Route for transit and regional development.

INSROP is a direct result of the normalization of the international situation and the Murmansk initiatives of the former Soviet Union in 1987, when the readiness of the USSR to open the NSR for international shipping was officially declared. The Murmansk Initiatives enabled the continuation, expansion and intensification of traditional collaboration between the states in the Arctic, including safety and efficiency of shipping. Russia, being the successor state to the USSR, supports the Murmansk Initiatives. The initiatives stimulated contact and cooperation between CNIIMF and FNI in 1988 and resulted in a pilot study of the NSR in 1991. In 1992 SOF entered INSROP as a third partner on an equal basis with CNIIMF and FNI.

The complete series of publications may be obtained from the Fridtjof Nansen Institute.

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PROGRAMME COORDINATORS

- **Yuri Ivanov, CNIIMF**
  Kavalergardskaya Str.6
  St. Petersburg 193015, Russia
  Tel: 7 812 271 5633
  Fax: 7 812 274 3864
  Telex: 12 14 58 CNIMF SU
- **Willy Østreng, FNI**
  P.O. Box 326
  N-1324 Lysaker, Norway
  Tel: 47 67 53 89 12
  Fax: 47 67 12 50 47
  Telex: 79 965 nanse n
  E-mail: Elin.Dragland @fni.
  wpoffice.telemax.no
- **Masaru Sakuma, SOF**
  Senpaku Shinko Building
  15-16 Toranomon 1-chome
  Minato-ku, Tokyo 105, Japan
  Tel: 81 3 3502 2371
  Fax: 81 3 3502 2033
  Telex: J 23704

INSROP PROJECT III.7.2

THE POTENTIAL OF THE NORTHERN SEA ROUTE FOR A REGULAR CARGO SERVICE

by

BRUCE BUCHAN

POLAR SHIPPING CONSULTANTS
LONDON

CONTENTS

1.0 INTRODUCTION

The final years of the Cold War and moves towards normalization of East-West relations saw a re-evaluation by the then Soviet Union of the potential of the Northern Sea Route (NSR). Military considerations had hitherto made opening the Route to Western commercial shipping unthinkable. However, in 1987 President Gorbachev, speaking in Murmansk, proposed that foreign ships be allowed to use the passage. Opening the Route was seen as a way of earning foreign currency and promoting economic development in the Russian Arctic.1

The NSR is the shortest shipping route from Europe to the Far East. It is a natural assumption that using it for this purpose will generate foreign exchange, but this premise requires careful examination. The removal of the military constraint does not automatically mean the Route is commercially viable. Harsh climatic conditions limit navigation without direct icebreaker and other technical support to a few months each year. Even during these few months ships of a high technical standard, with the attendant high capital and operating costs, are required.

Other commercial sea lanes are well established. Serious navigation of the NSR did not start until 1932 and the Soviet government's decision that year to open the Route was intended for voyages to and from the Arctic, not for commerecial transits. To establish the Route's potential for the latter, it is necessary to use the actual financial criteria applied to other shipping projects. Because we are covering new ground some of the costs, such as insurance, will have to be estimated; nonetheless, the results should give sufficient guidance as to whether the NSR is viable as a commercial passage.

2.0 METHOD OF ANALYSIS

The starting point in our analysis was the unique characteristics of the NSR and the restrictions they put on the route's commercial use. Trades had to be found which were compatible with these limitations. This meant studying cargo flows between Europe and the Far East as actual cargoes were offered by shippers to ship owners via the Baltic Exchange in London, the world's largest shipping market. Discussions with shippers or their representatives on the Baltic revealed whether the requirements of a particular trade were compatible with the Northern Sea Route. Once suitable trades were identified, the trading terms and ocean freight arrangements of the commodities in question were examined. These factors can differ drastically; the climatic features of the NSR are not the handicap to some trades that they are to others. Care was taken to select only well-established trades, in which the sale and shipping terms are well known and freight rates reliable. Financial calculations were made for voyages via the Northern Sea Route using the format for calculations used by ship owners to evaluate potential cargoes before agreeing to carry them.

3.0 TYPE OF SERVICE

An investigation of the potential for cargo movements between Europe and the Far East via the Northern Sea Route must consider two aspects. The first is the Route's use as a convenient or economical means of transit for the occasional vessel, the second a regular cargo service adapted to the distinctive features of the Route.

The occasional transit would, we must assume, be encouraged by the Russian government because of the revenue it might generate for the Sea Route authority by providing icebreaker support, etc. It is however, the potential for establishing a regular cargo service that is the subject of this report.

When considering a cargo service between Europe and the Far East the most common first reaction is to think of a scheduled liner service carrying high value cargo in containers. This is logical given the amount of cargo moved in this way and the common perception outside the industry that little else in the way of shipping exists. Therefore, it is not surprising that most of the discussion about a service using the Northern Sea Route has focused on this mode of shipping, envisioning an operation which would compete directly with the liner services presently trading via the Suez Canal. This is especially so when the starting point for such discussion is often statistics that do not distinguish between types of cargo, the types of ships required to carry them and the commercial arrangements under which the various cargoes are carried.

However, as Tor Wergeland [2] stated, while the transit time via NSR is shorter and so time-related costs lower than on other routes, its attraction to liner shippers would be offset by other factors. Low cost, which could be the NSR's big advantage, is not necessarily as important to many liner shippers as logistical effectiveness, i.e. reliability and punctuality of service. The NSR is at best logistically effective for a limited part of the year. Furthermore many shippers of containerized cargo could be reluctant to use this route because their products are delicate and could be damaged by ice or bad weather.

It is not that a container service via NSR cannot be offered, but it might be difficult to compete directly with those trading via the Suez and Panama Canals. The container market is not homogeonous. Its spectrum runs from large volume shippers requiring a year-round service with punctual sailings and predictable arrivals to the occasional shipper without such concerns.

Direct competition with the established container carriers would require special cellularized ships unsuitable for other types of cargo, especially the awkward and oversized pieces of equipment needed to develop resources in the Arctic. Cargo movements in and out of the Russian Arctic are beyond the scope of this study. It appears that an Atlantic/Pacific service could operate independently of local Arctic cargoes, but compatibility of the ships with local trade is potentially important and mitigates against an all-container service. Forms of service other than container-based appear more suited to the Northern Sea Route. Trades in which the savings from shorter transit times outweigh punctuality are more likely to take advantage of the NSR.

Generally, there are two extremes in the types of cargo vessel and the trades they serve. On the one hand are pure container ships running on a tightly scheduled cargo-liner service carrying high-value manufactured goods. Liner freight rates are set in advance by the shipping companies and are generally not negotiable.On the other hand are ships carrying raw materials and semi-finished goods on the tramp market. A tramp vessel follows no fixed itinery but is chartered for the most financially attractive cargo geographically convenient to its previous discharging port. Every tramp charter is negotiated by the ship owner and the charterer.

3.1 SPECIALIZATION

In between these extremes are the myriad of specialized types of shipping operations developed to serve specific commodities and/or geographical areas.Specialization applies to shipping, as in most fields. For our purposes it is relevant in two respects, cargo and geographic specialization.

Much of the dry cargo moved worldwide is straightforward to load, carry, and discharge. Expensive finished goods can be carried in containers. Low value cargoes such as coal or ore can be lifted in bulk carriers, ships that have only one deck and whose cargo holds are simply large boxes. In these cases the ship- owning company is concerned mainly with the management and navigation of the ship and with the well-being of the cargo during transit. The cargoes do not present any particular problems nor require a high degree of special knowledge. It is normal for the contract of carriage to be directly between the owner of the vessel and the shipper/charterer.

3.1.1. CARGO SPECIALIZATION

A considerable amount of international trade, however, consists of cargoes which need special knowledge or expertise. 'Break bulk' cargoes, those goods in individual crates or packages (even uncrated), have not disappeared with containerization. These cargoes generally have pieces too large, awkward or otherwise unsuitable for container stowage. Typical examples would be shipments of timber/paper products, steels, and 'project' cargo, consignments of unusual size or weight of construction materials and equipment, The shippers of such cargoes cannot use a conventional, non-specialized shipowner; they must either use one of the few actual ship owning companies which specialize in break-bulk/project cargoes along loosely specified routes or companies which provide a similar service without actually owning the ships they use.

3.1.2 GEOGRAPHIC SPECIALIZATION

Australia is an example of an area where special expertise has been necessary. The distinctive waterside labour practices and cost structure in that country have made traditional tramp ship owners reluctant to send their ships there. This could have meant that Australian exporters and importers were denied shipping services. This has not happened because companies knowledgable in Australian shipping practice act as intermediaries between cargo shipper and ship owner.

The Northern Sea Route qualifies as a geographically special area. Its physical and climatic characteristics call for specialized operational knowledge. Instead of an obstacle, this could be an opportunity for the right owner or operator to combine the required expertise in ice navigation and cargo operations to offer a cost effective alternative to the present routes between Europe and the Far East.

3.2 SHIP OPERATORS

A regular service, whether to carry a certain type of cargo or to cover a specific geographical area usually requires a number of ships, normally of similiar type, if not necessarily the same size. This is not always possible for a break-bulk service; while there may be many suitable ships available on the charter market it is rare for a single organization to own enough vessels to maintain a specialized operation. As mentioned about Australia, it is common to introduce a third party into the contractual relationship between the owner of a vessel and shipper/charterer of specialized cargo. This third party is known as an 'operator' and takes the role of owner in the commercial aspects of the voyage. The operator contracts with cargo shippers to

carry their goods on ships which he charters from their actual owners. The operator contributes the expertise required to carry the particular cargo.

An example of operators contributing their specialized knowledge is in the carriage of forest products from Canada. These cargoes regularly move in ships chartered to operators. The ships' owners entrust the special knowledge and experience required for loading, stowing, carrying and discharging these products to the operator, such as Seaboard and Canadian Transport.

Cargo is most cheaply carried in full-shipload lots, the size of the vessel corresponds to the distance the cargo is to be moved. Ships in short distance trades tend to be small, whereas deep sea, or long distance trades, are most economically served by large vessels. A feature of many of the break-bulk cargoes sold worldwide is that the individual shipments are small in size when compared to other cargoes transported simliar distances. Were such cargoes to be lifted as full cargoes in small ships the economics would make their international trade impossible. Because of this it is common practice to carry two or more small cargoes, or 'parcels', from the same or similiar loading areas to the same or similiar destinations in one vessel.

4.0 CHARTERING

The type of service described above is a hydrid between a scheduled liner service and a pure worldwide tramping operation. Like the former there is a concentration on moving cargoes between specific geographical areas but as with the latter the cargoes, whether full shiploads or parcels, move under charter contracts. An analysis of such a service must apply the economics of the tramp charter market rather than those of the liner market.

4.1 TYPES OF CHARTER

There are two common types of charter used for the carriage of sea-borne cargo:

4.1.1. Voyage charter: here the ship owner is paid on the basis of the amount of cargo lifted (usually a rate per weight ton or, in the case of wood products, per cubic metre). The cargo is carried betweenspecified ports, or an agreed range of ports. The owner is responsible for paying all the direct voyage expenses such as fuel, port charges, costs of canals, icebreakers etc.

Loading and discharging of cargo under a voyage charter are normally at the expense of the charterer/cargo owner. This is termed 'free in and out'(FIO) because it is done free of cost to the ship's owner. The freight rate includes a fixed time for loading and discharging (expressed either in working days or an amount of cargo per working day); should this time be exceeded, the owner is compensated by an agreed amount, known as demurrage, for each day beyond the allowed time. In certain trades, however, the owner must forgoe the certainty of FIO loading and discharging and to agree such terms as 'custom of port' (COP) or 'customary quick despatch' (CQD).

Unlike FIO, COP and CQD terms set out no exact time in which cargo must be loaded and discharged by the charterer. Because they rely on the ambiguous concept of a 'customary' speed of cargo operations at often unspecified ports, COP and CQD can lead to disputes over how much time should be allowed for cargo operations. An owner is more financially exposed because of the uncertainty over the time required to perform a voyage on this basis rather than on free in/out terms. Thus the freight rate may be higher than under FIO terms to allow for delays for which the owner will not be compensated. Most ship owners have insufficient knowledge of the trades or ports in question to agree these terms. Owners leave them to those with the relevant specialized

knowledge.

Cargoes like timber are often moved under 'liner terms', which means that the owner must arrange and pay for the loading and dicharging of cargo and that time for these operations is strictly at the owners' risk .Not even the nebulous obligations on charterers under COP and CQD terms apply.

4.1.2. Time charter is the hiring of a ship for a period of time, such as several months, a year, or even several years. Under a time charter a ship can perform from a few to many voyages, subject to the length of the charter. The charterer acts as the owner for commercial purposes; he is free to carry his own cargoes or, as an operator, to carry cargoes belonging to others. The charterer is responsible for those aspects of a voyage which would be the actual owners' obligations under a voyage charter such as port charges, fuel and canal transit costs. The actual owner remains (as with a voyage charter) responsible for the crew, maintaining and insuring the ship and repaying her capital cost.

Time charter hire is calculated as a fixed sum per day. Hire is payable to the actual owner from the moment the ship delivers into the charterers' service at an agreed place. A typical delivery point would be the pilot station at the first loading port on her first voyage under the time charter. Hire continues until the vessel is 'redelivered' to her owner, typically on dropping the pilot outbound from the final discharging port of the final voyage of the charter.

Voyage charter allows the owner of a cargo to move his goods with minimum involvement in the ocean shipping. Time charter permits a charterer to act as owner in commercial matters with the flexibility to send the ship where he wishes but without the long-term commitment of purchasing a ship and setting up an organization to manage her. Management is left to the actual owner.

4.2 TIME CHARTER TRIP

While voyage and time charter are the two main forms of charter. A form of charter which has elements of both has been developed. This is called the *time charter trip*. A time charter trip, like a voyage charter, normally covers a single voyage between one or more loading and one or more discharging ports. The vessel is, however, on timecharter to the charterer. The charterer pays the owner a daily sum of time charter hire and takes on the same obligations for direct voyage costs and arrangements as he would under a regular time charter. At the end of the voyage the ship is redelivered to

her owner. This is a popular method of chartering among operators who specialize is certain trades or within certain geographical areas. It allows an operator to charter a ship to cover specific voyage charter obligations without being concerned with the ship after the voyage is finished.

5.0 CHARTERING ECONCOMICS

5.1 TIME CHARTER EQUIVALENT

As a general rule, the workings of the charter market ensure that the potential return to a shipowner for different cargoes between comparable areas will be more or less the same. This return is measured in terms of 'time charter equivalent', which allows a comparison to be made between the expected returns from different potential charters, either of the same type or different type.

It can be seen that voyage and time charter arrangments are simply different ways of organizing the responsibilities between charterer and ship owner. Under a time charter the direct obligations and costs of performing a voyage charter are transferred from owner to charterer. When these direct voyage costs are deducted from the total freight income the amount remaining, divided by the number of days used on the voyage, should equal the vessel's market rate for a timecharter trip between the same areas as the voyage charter. This is called the 'time charter equivalent' rate. It allows a comparison between the voyage charter in question and other potential employment, including time charter.

Through voyage calculations such as those in the appendix to this paper, a tramp ship owner can select the vessel's next employment based on the estimated financial results of the alternatives.

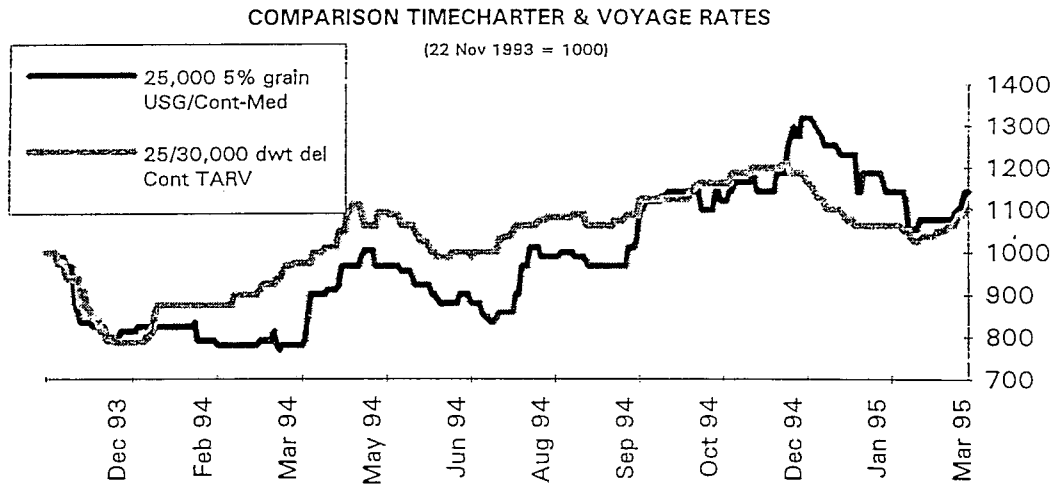
5.2 RELATIONSHIP BETWEEN VOYAGE FREIGHT AND TIME CHARTER RATES

We have seen that the charter market responds quickly to short-term changes in supply and demand. Income, expressed in daily charter hire or timecharter equivalent, for alternative charters between ports in similiar areas for similiar types of ship tends to correspond closely. For example, a 35,000 ton bulk carrier might be chartered for a time charter trip carrying steel products, delivering at Hamburg, redelivering Yokohama at a daily time charter rate of $ 15,000.

If the market mechanism is functioning properly a similiar time charter trip should pay the same, as should a charter on a voyage basis. Were the same vessel to take a cargo of bulk fertilizer from a western European port to Taiwan on a voyage charter, the freight will be payable per ton of cargo and the owner will be responsible for fuel, port charges, canal dues and other voyage expenses. When the voyage expenses are deducted from the lumpsum freight (freight rate x tons loaded) and the result divided

by the number of days between arriving at the load port and sailing from the discharge port we would expect the daily income (time charter equivalent) figure to approximate $ 15,000.00.

Such close correlation between time charter and voyage charter results from the almost perfect competition engendered by the supply and demand nature of the charter market. The close correlation between movements in voyage and time charter rates is illustrated by the following graph. This graph covers movements from United States Gulf ports to European and Mediterranean destinations, one of the most easily quantified markets, but the principle applies to all markets. The fluctuations in voyage freight levels, represented by the dark line are closely mirrored by the time charter levels in light colour.



Because of this relationship, we can base our conclusions on *representative* cargo movements, provided that the cargoes selected for calculation are from trades which are well-established and stable and that there is sufficient volume to support a shipping service.

5.3 COMPARISONS BETWEEN ATLANTIC AND PACIFIC RATES

To evaluate the results of the voyage calculations we must understand the mechanism which determines the voyage and time charter rates for voyages between Europe and the Far East.

Freight rates, whether in the tramp or liner markets, are derived from the level of demand for shipping services, both generally and on specific routes. The tramp market functions through pure supply and demand, responding quickly to changes in this relationship. While there can be quick changes in the short term market, general levels over the longer term and rate differentials between different geographical areas tend to be more stable.

For the last several years, demand, and therefore, rates, for vessels trading within the Atlantic have been higher than those for an equivalent vessel trading within the Pacific. Because a ship commands a better return by staying in the Atlantic, its owner will want a premium rate for a voyage to the Pacific, where her trading prospects will be diminished. Conversely, a ship trading in the Pacific must accept a low rate for cargo which will take the vessel to the Atlantic, where rates are better.

The disparity in rates for vessels trading within the Atlantic and for those trading within the Pacific is reinforced by two factors. First, there is more cargo moving under charter from the Atlantic directly to the Pacific than in the opposite direction. Second, once a tramp ship owner has sent his ship from the former to the latter he may not be prepared to accept the low rates for business back to the Atlantic. He will keep the ship in the Pacific, waiting for a return cargo which will pay a better than average rate. This indefinite delay in returning adds to the supply of tonnage and keeps inter-Pacific rates low relative to the Atlantic. This additional supply also exerts downward pressure on rates from the Pacific back to the Atlantic.

6.0 CARGOES

6.1 CARGOES FROM ATLANTIC TO PACIFIC

6.1.1 SEMI-FINISHED STEEL PRODUCTS

The rapidly developing economies of the Far East and South East Asia have for a number of years had a great demand for imported steel products. This demand has been well in excess of that which can be supplied domestically or even from other Pacific Rim nations. Consequently there is a large volume of such products as steel beams, reinforcing bars, sheets in bundles and coils, wire rods in coils and other steel products for the construction industry moving to the East.

This demand is expected to grow.[3] While domestic or local production for basic steels will also increase, the need for specialty steel should maintain import levels. The original source of supply for this trade was North America, but, as the trade grew dramatically in the late 1970's and early 80's Brazil became a major supplier.

By the late 1980's several operating companies were carrying steel from the east coast of North America and from Brazil to most of the countries of Asia.[4] Their method of operation is typical of operators worldwide. They make contracts on a voyage charter basis to carry various cargoes from the same or adjacent loading ports to discharge ports in another area. The carrying vessel is not named at the time of making the voyage contracts. When a sufficient number of cargoes have been booked in for a similiar loading period the operator will enter the market to charter in a ship, usually of 35,000 to 45,000 tons deadweight (total carrying capacity expressed in tons) on a time charter basis. As discussed earlier in this study, using a vessel of this size to lift a number of parcels of steels products of from, say, 2,000 to 15,000 tons each allows the operator to take advantage of economies of scale to offer low voyage freight rates.

The Northern Sea Route would, of course, be unsuitable for steel cargoes from Brazil, and North America is no longer a significant supplier.[5]. Over the last four to five years, however, increasing amounts of steel products have come from ports in the Baltic Sea such as Riga, Klaipeda, Gdansk and St. Petersburg. The NSR is, however, a suitable route to the Far East for steels from the Baltic because of its proximity to the loading ports.

The disadvantages of the NSR as a route for a scheduled liner service do not

necessarily apply to the steel trade. As discussed, a successful liner service depends to a large extent on predictable, punctual itineraries. Freight rates are less crucial.

In contrast, partially finished steel products are commodites undifferentiated by anything except cost at final destination. The market for steels is highly competitive. A steel trader usually finds that selling a cargo depends not on the commodity price but on the ocean freight rate. Often one dollar or less on the voyage freight will mean the difference between selling or not.[6]

Because several steel cargoes may be shipped aboard the same vessel, not necessarily from or to the same ports, the trade does not expect the same punctuality required of a liner service. Nor does the modest value of the cargo require an especially quick transit. Thus the uncertainty over transit times should present no problem.[7]

6.1.2 WOOD PRODUCTS

The Far East, especially Japan, has been a traditional market for North American wood products like sawn timber. In Japan imported timber is preferred to domestic cedar because foreign timber is uniform in quality.[8] Increasing demand has corresponded with restrictions on exports from the United States caused by environmental pressures. This has resulted in a doubling of North American lumber prices since 1992. The political impasse in the United States makes it unlikely that American exports will regain their position. In the meantime importers have turned to other sources and a trade in timber products from the Baltic to the Far East has developed.

An unusual feature of the Baltic timber trade is its reliance on liner terms which, as discussed above, means that the owner is responsible for the cost and time of loading and discharging. Under conventional chartering practice charterers are responsible for stevedoring. Because they are not familiar with loading under liner terms, and are therefore worried about the operation going awry, most tramp owners are unwilling to carry cargoes on this basis. But, as with other specialized operations such terms allow the regular carrier of such cargoes to develop an expertise and become a major participant in this market.

6.2 CARGOES FROM PACIFIC TO ATLANTIC

As discussed earlier, operators who are cargo or geographically based successfully compete for business by concentrating on these aspects. They are not necessarily, nor even usually, concerned with the management or navigation of the ships they employ.

It is normal for the operator of, for example, a steel service to rely on time chartered tonnage to perform its voyages, and for the ships so engaged to be under trip charters.

An operator chartering a vessel for a trip from the Baltic to the Far East, carrying parcels booked in on a voyage basis will usually redeliver the ship to her owner at the completion of her discharge in the East. The operator is not concerned with that vessel's further employment, concentrating instead on further Europe/Far East voyages. How the ship is employed after redelivery is the owners's affair.

The owner has various options. He can keep the ship in the Pacific or look for employment to take the ship back to the Atlantic immediately. Should the owner decide to send the ship to the Atlantic he must accept the low freight rates in that direction. The characteristics of the particular vessel will have a direct influence on the decision; the better the characteristics the easier to secure desirable further employment.

Modern ships with low fuel consumption, good deadweight and cubic capacity, large hatches and good cargo gear will have a better selection of potential business than a ship lacking these features. Her owner will consider all possibilities carefully, chosing the one which will give the best return. The owner will not necessarily be constrained by the need to find cargo to a particular destination.

In general, then, a tramp owner, especially an owner of modern tonnage, does not normally need to send his ship back to the Atlantic after the outwards leg from the Atlantic. This applies to the majority of ships presently used by operators to carry steel and other parcels from Europe to the Far East as they have precisely the desirable characteristics described above and which make a ship desirable to a time-charterer. Such a ship will thus have more potential for time charter employment, generally preferred by owners, than an ordinary ship. Further employment will range, for example, from voyage charters from West Coast North America with grain, also available to an ordinary ship, to be used on time charter by operators to load parcels, ranging from mineral sands to grain products to coal from Australia to the Far East and to Europe.

On the market prevailing at the time of this report, mid 1994, the 42,000 ton vessel used in calculation no. 5 was worth in the region of $ 15,000 per day for a timecharter trip or voyage basis timecharter equivalent from Europe to the Far East. Once free in the Far East she could command $ 10,000 per day for time charter trips within the

Pacific and only $ 6,500-7,000 for the trip back to Europe. It may well be to the owner's advantage to stay in the Pacific..

However, a company maintaining a regular service between Europe and the Far East using its own ships will not have the same scope for follow-on employment, especially if the ships are smaller and more ordinary than the modern 35/45,000 tonners used in the existing parcel trades via Suez. This is relevant to the present study because, as discussed below, we are using existing Russian Arctic vessels as a basis for calculation for the Northern Sea Route service. We must therefore focus on those cargoes which are normally available to the less sophisticated ship seeking to return to Europe on completion of their Atlantic to Pacific voyage.

6.2.1 AGRICULTURAL PRODUCTS

China and the Southeast Asian countries regularly export agricultural products such as tapioca, seed cakes and copra to Europe. Unfortunately, the value of these cargoes is low and the freight rates are correspondingly poor .The timecharter equivalent for these voyages is usually dismal and can be even worse should there be any delays on the voyage, a common occurrence.

If agricultural products are to be carried, the best result is obtained by limiting the voyage to one loadport and one discharge port. This is often commercially impossible. As with many commodities which are traded whilst afloat, the charterer will insist on the option of multiple discharge ports within a large geographical range for maximum sales flexibility.

6.2.2 CONTAINERS

It was stated at the beginning of this paper that a fully containerized service via the Northern Sea Route is unlikely to be viable. That does not rule out carrying containers for those shippers whose requirements are not so stringent as those of many liner shippers. Against a discounted freight rate of, for example, $ 2,000 per container it should be possible to book enough containers per voyage to supplement the voyage income and improve the result. One of the rules of successful operating is combining a cargo which can be loaded and discharged quickly and simply with a larger cargo, both to be loaded and discharged at the same or adjacent ports.

7.0 VOYAGE CALCULATIONS

Voyage calculations for notional voyages with cargoes selected from the actual cargo market are set out in the Appendix. These cargoes would, at present, obviously be carried via the southern route but, in this initial study we can assume that via the northern route the carrier could expect the same level of freight, with the shipper/receiver having the added benefit of earlier arrival.

During the summer season, when weather delay is minimal, it is possible to make a direct comparison between the northern and southern routes. Earlier or later in the year, when the weather is less favourable, comparisons will be more oblique and the financial calculations less clear cut. Voyage calculations should provide some indication of the NSR's potential during these marginal periods.

A regular service using the Northern Sea Route will be the result of combining a knowledge of the navigational aspects of the NSR with the expertise required to carry cargoes suited to the route's characteristics. In their stowage and carriage, cargoes like steel and timber require specific expertise. Loading and discharging at several ports on unusual terms mean that only those possessing the requisite knowledge will undertake their carriage.

7.1 SELECTION OF CARGOES

7.1.1. DRAFT CONSIDERATIONS

Arctic draft limitations mean that cargo combinations must be selected carefully. This is one reason for combining a high weight and low volume cargo, like steel, with one which has contrasting characteristics, such as wood. This will allow the ship to proceed with the maximum revenue producing cargo on a suitable draft.

7.1.2. PORTS

Care must also be taken in selecting ports. In China, the volume of imports has led to massive port congestion and long waiting times to discharge. This can be overcome by negotiating a Quick Despatch Agreement (QDA) with the Chinese authorities. While not cheap, a QDA is generally considered money well spent when set against the cost of serious delays to the vessel. As shown in voyage calculation no. 5, the cost of a QDA for a ship discharging steels at Huangpu and ZhangJiaGang is $ 14,300 and should ensure that the ship is discharged within an acceptable time. Demurrage rates

for the voyage basis cargoes often do match the daily time charter (or timecharter equivalent) rate. A long wait to discharge can be disastrous. For the Huangpu cargo a reasonable limit on the time for discharge is particularly essential, as the discharging terms are customary quick despatch.

7.2 BASIS FOR CALCULATION

7.2.1 THE SHIPS

To minimize arbitrary assumptions, this study uses one of the types of vessel currently trading on the Northern Sea Route, the 'Mikhail Strekalovskiy' class of the Murmansk and the Far Eastern Shipping Companies. These ships have only one deck and thus unobstructed cargo holds suitable for cargoes in bulk, such as grain or coal, or for breakbulk cargoes like steels and wood. They were built in the late 1970s and early 80s and are of about 20,000 deadweight tons capacity.We assume that this size is due to draft limitations in the Russian Arctic, as ships of this type built for general trading during this period tended to be at least 8,000 to 10,000 tons larger.

Single deck vessels are most suitable for the cargoes used in this paper. As we have seen, ships used for breakbulk services between the Atlantic and Pacific are of at least 35,000 tons deadweight. This is accepted as the minimum size for the economies of scale necessary for these trades. The smaller 'Mikhail Strekalovskiy' type vessels would seem unable to compete with these larger ships and so perhaps unsuitable for a service via NSR. However, the shorter transit time via the northern route may to some extent offset the size disadvantage. The calculations in the appendix use actual voyage freight rates for the cargoes carried. If the results indicate that the ships can earn at least the same time charter equivalent as they can on the open tramp market, there is potential for a service via the Northern Sea Route.

7.2.2 OTHER CALCULATION FACTORS

Fuel is based on prices prevailing at the time of writing. While the general level charter rates is not directly linked to the cost of fuel, the owner of a ship with a higher fuel consumption than another vessel competing for a charter must adjust the rate. This is done by the owner accepting a lower time charter or time charter equivalent rate in order to keep the overall transport price to the charterer equal to that attainable from a more fuel-efficient ship.

Port costs, including those for loading and discharging are the actual costs obtained either from shipping agents at the particular ports or from the port costs advice service

of the Baltic and International Maritime Council (BIMCO) in Copenhagen.

Costs for icebreaker support and inspection prior to transit were obtained from the Northern Sea Route Authority. The information supplied by the Authority made no distinction between fees for Russian and foreign flag ships. It was stated, however, that discounts could be offered to regular users of the NSR so it is assumed that a foreign operator of a regular service would benefit from this at least to the extent of equal treatment with a Russian service. Because questions remain as to the precise assessment and application of the fees for transit we were unable to be as accurate as we would have wished. This means,however, that the NSR transit portion of the calculations is conservative and, with more detailed information the results may improve.

7.3 FINANCIAL RESULTS OF VOYAGE CALCULATIONS

The criterion used for determining the potential for a cargo service via NSR is whether the ships used for calculation, carrying cargoes which are normally carried on larger vessels via Suez, obtain at least the same time charter equivalent that they could achieve by trading on the open market. As shown in the summaries below of the voyage calculations in the appendix, this is achieved, even surpassed, by the carriage of steels and wood products from the Baltic to China and Japan.

As we have seen, rates on the general tramp market tend to be considerably higher in the Atlantic to Pacific direction than the opposite. A vessel of this type could, at mid 1994 market levels, expect a time charter (or equivalent) level of $ 6,500 - 7,000 per day, subject to the duration and destination. Bearing in mind that the voyage calculations in this paper are very conservative, we can consider the results of the NSR calculations in line with the general market. For voyage cargoes in this direction they can be summarized as follows:

Calculation	Voyage	Time charter equivalent
1.	Wood products Finland/Japan	$ 5,997
2.	Steel and wood products Russia + Finland/Japan + China	$ 6,958

Combining cargoes and ports give a result similiar to that obtainable on a time charter trip on the actual market.

At the time of writing, a 'Strekalovskiy' type would have been worth about $ 4,000 per day for a time charter trip from the Far East to Europe. The low voyage rates from Pacific back to the Atlantic give poor time charter equivalent results. Agricultural products, whose shippers manage to extract low freight rates and slow loading and discharging terms from owners are typical. The result of a voyage with feed grains from China to Europe is shown in estimate no.3 ; we see that the time charter equivalent is a poor $ 1,393 per day. When repositioning a ship by carrying poorly paying cargo like agricultural products, an owner will try to perform the voyage as quickly as possible, minimizing the number of days so that more remunerative employment can be undertaken quickly. For this the NSR could be useful by providing a faster route to Europe.

Despite this mitigating factor, the result of such a cargo is not encouraging. Were we to calculate a round voyage starting and finishing in Europe by combining calculations no 2. and 3., steels and timber from the Baltic to China and Japan followed by agricultural products from China to the continent, the result over the required 116 days would be $ 4,467 time charter equivalent per day. This figure is unlikely to justify a service. An overall return in excess of $ 5,000 per day would be needed to equal the timecharter trip level from Atlantic to Pacific and back. However it is possible to find suitable combinations of cargo to improve these figures. By adding a deck cargo of containers from Japan to Rotterdam the result of the China/Hamburg agricultural products voyage improves greatly (calculation 4), as does a round voyage combination with steels and wood from the Baltic (2 + 4)

Return employment from the Pacific appears in line with time charter rates and the combination cargoes, which require some sort of (at least minimal) infrastructure associated with a service seem to show a better result than straight tramp voyages.

Calculation	Voyage	Time charter equivalent
3.	Agricultural products China/Germany	$ 1,393
4.	Agricultural products + containers China + Japan/Holland + Germany	$ 4,387
2. + 4.	Combination round voyage Baltic/Far East/Europe	$ 5,690

8.0 OPERATING A SERVICE - CHARTERED VS. OWNED VESSELS

A break-bulk operation can consist of ships which are either owned directly by the carrier offering the service or time chartered (in some cases both). There are advantages and disadvantages to each approach.

8.1 VESSELS CHARTERED UNDER TIME CHARTER TRIPS

It will be recalled that changes in the levels of voyage and time charter rates on the spot (early) market correspond closely. A fall in rates for cargoes which the operator is booking in should be mirrored by a similiar reduction in the time charter trip market. This will generally shield the operator from serious losses on the difference between the freight received from the voyage shippers and the hire which must be paid to the ship's owner. The profit from the economy of scale due to booking small cargoes on a large ship can be maintained.

There is the risk that the market will move upwards between the time the operator books in the voyage cargoes and charters a ship to carry them. While this risk is generally managable on the spot market, an operator must be cautious about negotiating a contract for serveral cargo liftings over a period of time. Should the market rise before the contract is completed the operator will have to pay more for the timechartered vessel than is justified by the contract's voyage rates. Contracts can be the foundation of a regular service but can, in these circumstances, lead to a serious, sometimes fatal, cash drain for a timecharter operator.

8.2 OWNED VESSELS

The costs of directly owned ships are not linked to the charter market. They are known in advance and so will not follow voyage rates upwards should the market increase. The benefits of increased rates on a rising market will flow directly to the owner. (The owner will suffer if rates drop below operating and capital costs, but this is a risk that all shipowners bear).

Initially, because of the Northern Sea Route's requirement for heavily ice-strengthened vessels, most, if not all of the ships used in a regular service would have to be owned or at least under the direct control of the service. Ships built for the general tramp market rarely have a sufficiently high ice classification to transit the Northern Route. Few owners expect to trade their ships in heavy ice, so the capital cost of ice strengthening is not worthwhile. Should the NSR become an accepted

commercial trade route, it could well be that future tramp ships incorporate better ice classification. This would allow them to be chartered to operators using the Northern Sea Route. Many owners are keen to add features which enhance their ships' trading prospects.

9.0 CONCLUSION

The harsh conditions in the Russian Arctic mean that the Northern Sea Route has distinct disadvantages as a commercial sea lane. Navigation without direct assistance is limited to a few months per year. Punctuality and reliability of service cannot be guaranteed. The vessels able to transit the route require such expensive features as heavy ice strengthening and powerful engines.

Despite these disadvantages, with the right type of cargoes ships on this route can achieve returns equal to what is available on other routes during the time of year when transits are possible without extensive icebreaker support. The results of the voyage calculations indicate that when used for commercial trades in which cost is more important than delivery on a fixed schedule at regular intervals the Northern Sea Route is a viable alternative to the Suez route.

NOTES

1. Brown-Humes, Christopher: 'Melting Through the Ice-Age Barrier', *Lloyd's List,* London, 21 August 1990, page 5.

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3. Internal memorandum Stemcor U.K. Limited, London, February 1994, citing recent article in *South China Morning Post*, 'Shortage of Steel Forecast Despite Rise in Production'.

4. Interview with Edward Dicks, Barks Williams Shipping Limited, London.

5. Interview with Edward Dicks.

6. Interview with Edward Pivcevic, Stemcor U.K. Limited, London.

7. Interview with Ekins Pollard, Stemcor U.K. Limited.

8. Nakamoto, Michiyo: 'Wood Row Goes Against the GATT Grain', *Financial Times*, London, 1 March 1994, page 4.

APPENDICES

A. Explanatory notes on voyage calculations

B. Voyage calculations:

1-4: Mikhail Strekalovskiy types via Northern Sea Route

5-6: 42,000 ton deadweight bulk carrier steels and steels + wood products Baltic to Far East via Suez

APPENDIX A.

EXPLANATORY NOTES ON VOYAGE CALCULATIONS

Because the voyage calculations, or estimates, in this study are on a format used by actual ship owners, some of the terminology will be unfamiliar to the reader not involved in commercial shipping.

Terms refers to whether the charterer or owner is responsible for loading and discharging the cargo and how much time is permitted for these operations. In voyage estimate number 2 the first cargo is to be loaded at a rate of 1,500 tons per day and discharged at 1,000 tons per day, both excluding Saturdays, Sundays and holidays. Loading and discharge will be arranged and paid for by charterers, free of expense to the owner. From the main text it will be recalled that the second and third cargoes are to be loaded at owner's time and expense; they are to be discharged at charterer's expense at the customary rate per day at the particular ports.

Sea Days is the transit time between ports. For an accurate calculation the voyage to the first loading port from the final discharging port on the previous voyage is included. Thus, the ship in calculation number 2 is considered to have finished her previous employment in Antwerp and to have proceeded to St. Petersburg empty ('in ballast') via the Kiel Canal. It is customary to include a margin of about 10% extra in the transit time to allow for weather delays at sea.

Port Days are the days spent in port, both for loading and discharging, and waiting for these operations to commence or resume.

The *Revenue* section is self-explanatory except for the commission. Normally cargoes are arranged through at least two brokers, one representing the ship owner and the other the cargo interests. These brokers are paid via a commission which is calculated as a fixed percentage of the freight. The owner's calculation must be based on net revenue and so the commission applicable to each cargo is is deducted.

Fuel Consumption. A deep-sea cargo vessel requires two types of fuel. Her main engine is fueled by partially refined oil, known as intermediate fuel oil (IFO). The electicity needed throughout the ship is supplied by generators run with highly refined marine diesel oil or gas oil (MDO or MGO). The price of fuel is directly related to the amount of refining it has undergone; IFO is therefore less expensive than MGO.

The figures given after 'At sea' and 'In port' are the number of tons per day of each type of fuel consumed by this type of ship. The figures after 'Prices' are the prices per ton delivered to the ship.

Vessels built through the late 1970's and early 1980's use both the main engine and generators while at sea. Ships built from the mid 1980's incorporate an electrical generator attached to the propeller shaft so that they do not need to burn diesel or gas oil in transit. All ships burn diesel or gas oil in their generators while in port. On the estimates for the Strekalovskiy types the gas oil figure in port is slightly higher because electricity must be produced to operate the cargo gear.

Port costs include such items as the dues paid to the port authority for the use of port facilities and the costs of entering and leaving the port, such pilots and tugboats. There will also be a fee to the agent engaged to represent the owner while the vessel is in port.

Stevedoring is the cost of loading or discharging the ship under liner terms. *Teu* (estimate no. 4) is the abbreviation for 'twenty equivalent unit', industry jargon for a cargo container twenty feet in length.

Slings are the cords used to attach bundles of sawn timber to ships' cargo cranes for loading and discharging. Under liner terms they are an owner's expense.

The figure shown as *Per day* is the time charter equivalent rate derived after deducting the voyage expenses from the net revenue and dividing the result by the number of days used on the voyage.

'Grossed up at'. The *per day* figure is net of commissions payable to brokers. For comparison with other potential cargoes and for negotiation (during which rates will include commission) it is necessary to add a suitable commission figure to the net amount.

VOYAGE ESTIMATE

Cargo	Load Port	Discharge Port	Terms	Estimate no.1
1- 12,500 cbm sawn timber	Kokkola	Onahama + Chiba + Nagoya	liner in/free out custom of port	

Sea Days	*Days*
Hamburg/Kokkola	3
Kokkola/Onahama	26
Onahama/Chiba	1
Chiba/Nagoya	2
Total	32

Fuel Consumption	*IFO*	*MGO*
At Sea	28	2.5
In Port	0	3
Prices	$80	$160
Total (tons)	896	134
Costs	$71,680	$21,440

Port Days	
Kokkola	9
Onahama	3
Chiba	3
Nagoya	3
Total	18

Total Days	50

Revenue	Cargo #1	
cbm	12,500	
Freight per mt (cbm)	$60	
Gross freight	$750,000	
less commission	$18,750	2.50%
Net Freight	$731,250	

Revenue	Cargo #2	
cbm		
Freight per mt (cbm)		
Gross freight	$0	
less commission	$0	
Net Freight	$0	

Revenue	Cargo #3	
cbm		
Freight per mt (cbm)		
Gross freight		
less commission	$0	
Net Freight	$0	

TOTAL REVENUE			$731,250
Total Fuel Costs		$93,120	
Port Costs			
Kokkola	$38,000		
Onahama	$22,300		
Chiba	$27,490		
Nagoya	$27,100		
Total Port Costs		$114,890	
Stevedoring	$75,000		
Slings	$21,000		
Sub Total		$96,000	
Icebreaker support, pilotage & inspection	$68,910		
Kiel Canal dues	$16,000		
Extra Insurance	$50,000		
Sub Total		$134,910	
TOTAL COSTS			$438,920
NET REVENUE			$292,330
per day		$5,847	
Grossed up at	2.50%	$5,997	

VOYAGE ESTIMATE

Cargo	Load Port	Discharge Port	Terms	Estimate no.2
1- 10,000 mt steel billets	St. Petersburg	Shantou	1,500/1,000 free in & out	
2- 2,000 cbm sawn timber	Kotka	Onahama	liner in/free out custom of port	
3- 4,000 cbm sawn logs	Kotka	Abashiri	liner in/free out custom of port	

Sea Days	*Days*
Antwerp/St. Petersburg	4
St. Petersburg/Kotka	1
Kotka/Abashiri	23
Abashiri/Onahama	2
Onahama/Shantou	5
Total	35

Port Days	
St. Petersburg	8
Kotka	3
Abashiri	2
Onahama	2
Shantou	14
Total	29

Total Days	64

Revenue	Cargo #1	
m.tons	10,000	
Freight per mt (cbm)	$50	
Gross freight	$500,000	
less commission	($25,000)	5.00%
Net Freight	$475,000	

Revenue	Cargo #2	
cbm	$2,000	
Freight per mt (cbm)	$51	
Gross freight	$102,000	
less commission	$2,550	2.50%
Net Freight	$99,450	

Revenue	Cargo #3	
cbm	$4,000	
Freight per mt (cbm)	$65	
Gross freight	$260,000	
less commission	$6,500	2.50%
Net Freight	$253,500	

Fuel Consumption	*IFO*	*MGO*
At Sea	28	2.5
In Port	0	3
Prices	$80	$160
Total (tons)	980	174.5
Costs	$78,400	$27,920

TOTAL REVENUE			$827,950
Total Fuel Costs		$106,320	
Port Costs			
St. Petersburg	$45,000		
Kotka	$25,000		
Abashiri	$19,395		
Onahama	$17,412		
Shantou	$20,521		
Total Port Costs		$127,328	
Stevedoring	$28,000		
Slings	$2,800		
Sub Total		$30,800	
Icebreaker support, pilotage & inspection	$68,910		
Kiel Canal dues	$16,000		
Extra Insurance	$50,000		
Sub Total		$134,910	
TOTAL COSTS			$399,358
NET REVENUE			$428,592
per day		$6,697	
Grossed up at	3.75%	$6,958	

VOYAGE ESTIMATE

Cargo	Load Port	Discharge Port	Terms	Estimate no. 3
1- 13,000 tons agricultural products	Dalien	Hamburg	1,000/2,000 flo	

Sea Days	*Days*
Shantou/Dalien	6
Dalien/Hamburg	26
Total	32

Fuel Consumption	*IFO*	*MGO*
At Sea	28	2.5
In Port	0	3
Prices	$80	$160
Total (tons)	896	140
Costs	$71,680	$22,400

Port Days	
Dalien	12
Hamburg	8
Total	20

Total Days	52

Revenue	Cargo #1	
m.tons	13000	
Freight per mt (cbm)	$28	
Gross freight	$364,000	
less commission	$18,200	5.00%
Net Freight	$345,800	

Revenue	Cargo #2
cbm	
Freight per mt (cbm)	
Gross freight	
less commission	
Net Freight	$0

Revenue	Cargo #3
cbm	
Freight per mt (cbm)	
Gross freight	
less commission	
Net Freight	$0

TOTAL REVENUE			$345,800
Total Fuel Costs		$94,080	
Port Costs			
Dalien	$38,000		
Hamburg	$26,000		
Total Port Costs		$64,000	
Stevedoring			
Slings			
Sub Total		$0	
Icebreaker support, pilotage & inspection	$68,910		
Kiel Canal dues			
Extra Insurance	$50,000		
Sub Total		$118,910	
TOTAL COSTS			$276,990
NET REVENUE			$68,810
per day		$1,323	
Grossed up at	5.00%	$1,393	

VOYAGE ESTIMATE

Cargo	Load Port	Discharge Port	Terms	Estimate no. 4
1- 13,000 agricultural products	Dalien	Hamburg	1,000/2,000 flo	
2- 160 twenty foot containers	Osaka	Rotterdam	liner load/liner discharge	

Sea Days	*Days*
Shantou/Dalien	6
Dalien/Osaka	3
Osaka/Rotterdam	25
Rotterdam/Hamburg	2
Total	36

Fuel Consumption	*IFO*	*MGO*
At Sea	28	2.5
In Port	0	3
Prices	$80	$160
Total (tons)	1008	162
Costs	$80,640	$25,920

Port Days	
Dalien	12
Osaka	2
Rotterdam	2
Hamburg	8
Total	24

Total Days	60

Revenue	Cargo #1	
m.tons	13000	
Freight per mt (cbm)	$28	
Gross freight	$364,000	
less commission	$18,200	5.00%
Net Freight	$345,800	

Revenue	Cargo #2	
teu	160	
Freight per teu	$2,000	
Gross freight	$320,000	
less commission	$12,000	3,75
Net Freight	$308,000	

Revenue	Cargo #3	
cbm		
Freight per mt (cbm)		
Gross freight		
less commission		
Net Freight		

TOTAL REVENUE			$653,800
Total Fuel Costs		$106,560	
Port Costs			
Dalien	$38,000		
Osaka	$30,000		
Rotterdam	$25,000		
Hamburg	$26,000		
Total Port Costs		$119,000	
Stevedoring - containers	$56,000		
Sub Total		$56,000	
Icebreaker support, pilotage & inspection	$68,910		
Extra Insurance	$50,000		
Sub Total		$118,910	
TOTAL COSTS			$400,470
NET REVENUE			$253,330
per day		$4,222	
Grossed up at	3.75%	$4,387	

VOYAGE ESTIMATE

	Cargo	Load Port	Discharge Port	Terms	Estimate no. 5
1-	10,000 tons steel billets	St. Petersburg	ZhangJiaGang	1,500/1,000 fio	
2-	22,000 tons steel products	St. Petersburg	Huangpu	1,500 free in/CQD out	
3-	4,000 cbm sawn logs	Kotka	Abashiri	liner in/free out COP	
4-	2,000 cbm sawn timber	Kotka	Onahama	liner in/free out COP	

Sea Days	*Days*
Hamburg/St. Petersburg	4
St. Petersburg/Kotka	1
Kotka/Port Said + transit	15
Suez/Huangpu	21
Huangpu/ZhangJiaGang	3
ZhangJiaGang/Onahama	4
Onahama/Abashiri	3
Total	51

Fuel Consumption	*IFO*	*MGO*
At Sea	21	
In Port	0	3
Prices	$80	$160
Total (tons)	1071	141
Costs	$85,680	$22,560

Port Days	
St. Petersburg	17
Kotka	3
Huanpu	18
ZhangJiaGang	5
Onahama	2
Abashiri	2
Total	47

Total Days	98

Revenue	Cargo #1	
m.tons	10000	
Freight per mt (cbm)	$50	
Gross freight	$500,000	
less commission	$25,000	5.00%
Net Freight	$475,000	

Revenue	Cargo #2	
cbm	22000	
Freight per mt (cbm)	$46	
Gross freight	$1,012,000	
less commission	$37,950	3.75%
Net Freight	$974,050	

Revenue	Cargoes 3+4	
cbm	6000	
Freight per mt (cbm)	$60	
Gross freight	$360,000	
less commission	$9,000	2.50%
Net Freight	$351,000	

TOTAL REVENUE			$1,800,050
Total Fuel Costs		$108,240	
Port Costs			
St. Petersburg	$45,000		
Kotka	$35,000		
Huangpu	$40,000		
ZhangJiaGang	$38,000		
Onahama	$21,000		
Abashiri	$20,000		
Total Port Costs		$199,000	
Stevedoring	$28,000		
Slings	$2,800		
Sub Total		$30,800	
Kiel Canal dues	$24,000		
Suez Canal	$120,000		
Quick Despatch China	$14,300		
Sub Total		$158,300	
TOTAL COSTS			$496,340
NET REVENUE			$1,303,710
per day		$13,303	
Grossed up at	3.75%	$13,821	

VOYAGE ESTIMATE

Cargo	Load Port	Discharge Port	Terms	Estimate no. 5
1- 10,000 tons steel billets	St. Petersburg	ZhangJiaGang	1,500/1,000 fio	
2- 22,000 tons steel products	St. Petersburg	Huangpu	1,500 free in/CQD out	
3- 4,000 cbm sawn logs	Kotka	Abashiri	liner in/free out COP	
4- 2,000 cbm sawn timber	Kotka	Onahama	liner in/free out COP	

Sea Days		*Days*
Hamburg/St. Petersburg		4
St. Petersburg/Kotka		1
Kotka/Port Said + transit		15
Suez/Huangpu		21
Huangpu/ZhangJiaGang		3
ZhangJiaGang/Onahama		4
Onahama/Abashiri		3
	Total	51

Fuel Consumption	*IFO*	*MGO*
At Sea	21	
In Port	0	3
Prices	$80	$160
Total (tons)	1071	141
Costs	$85,680	$22,560

Port Days		
St. Petersburg		17
Kotka		3
Huanpu		18
ZhangJiaGang		5
Onahama		2
Abashiri		2
	Total	47

Total Days	98

Revenue	Cargo #1	
m.tons	10000	
Freight per mt (cbm)	$50	
Gross freight	$500,000	
less commission	$25,000	5.00%
Net Freight	$475,000	

Revenue	Cargo #2	
cbm	22000	
Freight per mt (cbm)	$46	
Gross freight	$1,012,000	
less commission	$37,950	3.75%
Net Freight	$974,050	

Revenue	Cargoes 3+4	
cbm	6000	
Freight per mt (cbm)	$60	
Gross freight	$360,000	
less commission	$9,000	2.50%
Net Freight	$351,000	

TOTAL REVENUE			$1,800,050
Total Fuel Costs		$108,240	
Port Costs			
St. Petersburg	$45,000		
Kotka	$35,000		
Huangpu	$40,000		
ZhangJiaGang	$38,000		
Onahama	$21,000		
Abashiri	$20,000		
Total Port Costs		$199,000	
Stevedoring	$28,000		
Slings	$2,800		
Sub Total		$30,800	
Kiel Canal dues	$24,000		
Suez Canal	$120,000		
Quick Despatch China	$14,300		
Sub Total		$158,300	
TOTAL COSTS			$496,340
NET REVENUE			$1,303,710
per day		$13,303	
Grossed up at	3.75%	$13,821	

VOYAGE ESTIMATE

Cargo	Load Port	Discharge Port	Terms	Estimate no. 6
1- 10,500 tons steel plates	Klaipeda	Singapore	2,000/1,500 flo	
2- 10,000 tons wire rods	Klaipeda	Beilun	1,500/1,500 flo	
3 14/20,000 tons steel angles	Riga	Beilun + Huangpu	2,000/1,500 flo	

Sea Days	*Days*
Hamburg/Riga	3
Riga/Klaipeda	1
Klaipeda/Port Said	13
Suez Canal Transit	1
Suez/Singapore	16
Singapore/Huangpu	5
Huangpu/Beilun	3
Total	42

Fuel Consumption	*IFO*	*MGO*
At Sea	21	0
In Port	0	3
Prices	$80	$160
Total (tons)	882	111
Costs	$70,560	$17,760

Port Days	
Riga	8
Klaipeda	7
Singapore	6
Huangpu	6
Beilun	10
Total	37

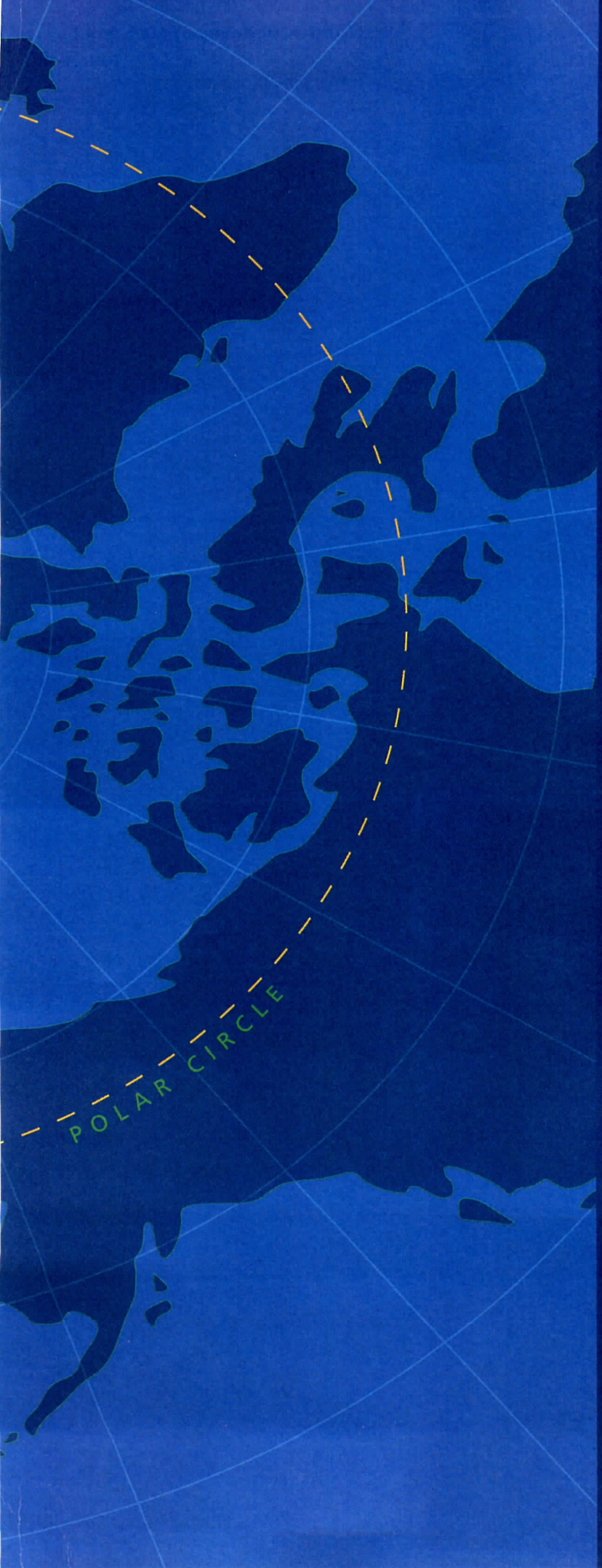
Total Days	79

Revenue	Cargo #1	
m.tons	10500	
Freight per mt (cbm)	$42	
Gross freight	$441,000	
less commission	$11,025	2.50%
Net Freight	$429,975	

Revenue	Cargo #2	
m.tons	10000	
Freight per mt (cbm)	$48	
Gross freight	$480,000	
less commission	$18,000	3.75%
Net Freight	$462,000	

Revenue	Cargo # 3	
m.tons	18000	
Freight per mt (cbm)	$40	
Gross freight	$720,000	
less commission	$18,000	2.50%
Net Freight	$702,000	

TOTAL REVENUE			$1,593,975
Total Fuel Costs		$88,320	
Port Costs			
Riga	$35,000		
Klaipeda	$30,000		
Singapore	$25,000		
Huangpu	$18,000		
Beilun	$23,000		
Total Port Costs		$131,000	
Stevedoring			
Slings			
Sub Total		$0	
Kiel Canal dues	$24,000		
Suez Canal	$120,000		
Quick Despatch China	$18,200		
Sub Total		$162,200	
TOTAL COSTS			$381,520
NET REVENUE			$1,212,455
per day		$15,348	
Grossed up at	2.50%	$15,741	



The three main cooperating institutions of INSROP

Ship & Ocean Foundation (SOF), Tokyo, Japan.

SOF was established in 1975 as a non-profit organization to advance modernization and rationalization of Japan's shipbuilding and related industries, and to give assistance to non-profit organizations associated with these industries. SOF is provided with operation funds by the Sasakawa Foundation, the world's largest foundation operated with revenue from motorboat racing. An integral part of SOF, the Tsukuba Institute, carries out experimental research into ocean environment protection and ocean development.

Central Marine Research & Design Institute (CNIIMF), St. Petersburg, Russia.

CNIIMF was founded in 1929. The institute's research focus is applied and technological with four main goals: the improvment of merchant fleet efficiency; shipping safety; technical development of the merchant fleet; and design support for future fleet development. CNIIMF was a Russian state institution up to 1993, when it was converted into a stock-holding company.

The Fridtjof Nansen Institute (FNI), Lysaker, Norway.

FNI was founded in 1958 and is based at Polhøgda, the home of Fridtjof Nansen, famous Norwegian polar explorer, scientist, humanist and statesman. The institute spesializes in applied social science research, with special focus on international resource and environmental management. In addition to INSROP, the research is organized in six integrated programmes. Typical of FNI research is a multi-disciplinary approach, entailing extensive cooperation with other research institutions both at home and abroad. The INSROP Secretariat is located at FNI.