INNOVATIVE SYSTEM FOR THE TRANSPORTATION OF PAPER

INOVATIVNÍ SYSTÉM DISTRIBUCE HOTOVÝCH PAPÍROVÝCH VÝROBKŮ

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Summary: This paper deals with new Transport Supply System. One type of intermodal container built to transport bulk cargo like paper on railway and ship is Stora Enso Cargo Unit. This Unit is too big and heavy to be transported on road, and instead they are transported only by railway and ship. NETTS (North European Transportation and Supply System) is a delivery and transportation system developed by Stora Enso. Its aim is to offer competitive transportation costs to plants operating in northern Finland, to increase the frequency of shipping as well as to improve customer service, minimise damage and develop shipment tracking. The multimodal transport system essentially integrates the Swedish railways with North Sea traffic for the supply of paper and board products from Sweden and Finland to Europe.

Key words: container, Supply System, paper, distribution

Anotace: Příspěvek popisuje inovativní logistický systém, který je určen pro přepravu papíru. Jedná se o speciální přepravní jednotku SECU, ocelový kontejner integrovaný s tzv. Ro-Ro kazetou, umožňující manipulaci pomocí terminálových traktorů a trajlerů. Vnitřek kontejnerů je uzpůsoben pro ložení rolí papíru, u nové generace SECU je pak možné provádět nakládku rolí plně automaticky. Pro snadnou identifikaci jsou SECU vybaveny RFID tagy. Tento systém je využíván od konce roku 1999 nejprve jen v rámci Švédska a od roku 2005 i se zapojením Finska. Tím byl zaveden zcela nový systém distribuce hotových výrobků (role papíru), který je nyní označován jako NETSS (North European Transport Supply System).

Klíčová slova: kontejner, logistický systém, papír, distribuce

1. Introduction

New forms of logistics, including the development and operation of supply chains and logistics technology, are the means that integrate suppliers, producers and customers. The awareness and importance of logistic technology as a competitive factor is increasing. The most important issue in developing logistic technology solution is the solutions attractiveness to the cargo owners. The success of a logistic solution is dependent on its capability to transport cargo in both directions (no matter what kind of transport). To achieve this, the solution must be cost effective, flexible, and short lead-times.

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One type of special intermodal container (shipping container) built to transport bulk cargo like paper on railway and ship is Stora Enso Cargo Unit - SECU. This Unit is too big and heavy to be transported on road (ISO-Containers are designed to fit roads), and instead they are transported only by railway (special railway waggons) and ship (ship for paper reels). A special vehicle or crane is used to load and unload them. Special railcars are also needed in the terminal operations (they can be transported on truck ferries).

2. Stora Enso Cargo Unit

With the new system SECU, the Stora Enso group takes an important step towards an environment friendly, efficient and ergonomic handling of transport of paper reels on their way between paper mill and customers.

In November 1999 SECU started to be used at Stora Enso Hylte. SECU is described as a larger variant of a big sea container, and is especially developed in order to give maximum transport efficiency on the railroad lines which are adapted for those massive transports.

Potential damage to the reels is also limited by the specially designed containers known as SECUs. A SECU looks like a standard 40 foot container (ISO container), but has special dimensions (13.8 x 3.6 x 3.6 m) which allow the group to increase shipping capacity and flexibility, as well as reducing environmental impact. The SECU can hold up to 80 tonnes of goods (reels paper, another goods), which is far more than the average 22 tonne load that is permitted to travel by road in Europe. Into box can load max. 44 Euro-pallets. Instead of the usual paperwork attached to each container, there is a simple radio tag (in box) which stores all the relevant data required by the terminal management to keep track of the Secu. The SECU has been designed to meet the Swedish rail profile (called gauge C) and according to North Sea Shipping requirements. The SECU is basically a weather-protected cassette with legs that make it possible to go from rail to North Sea RoRo service. [2]

Source: [1]

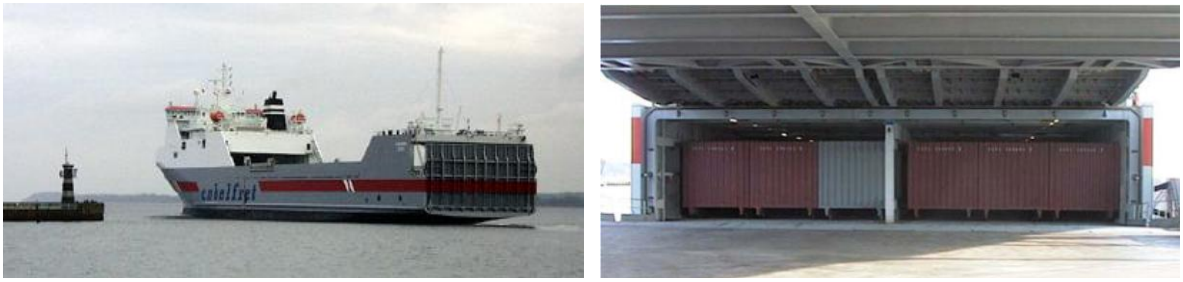
Fig. 1: SECU box with standard containers

The SECU can be forwarded at Sea and on European in land waterways but not on Continental European rail network (only on approved Swedish Rail lines).

Source: [3]

Fig. 2: The SECU on trailer and on rail

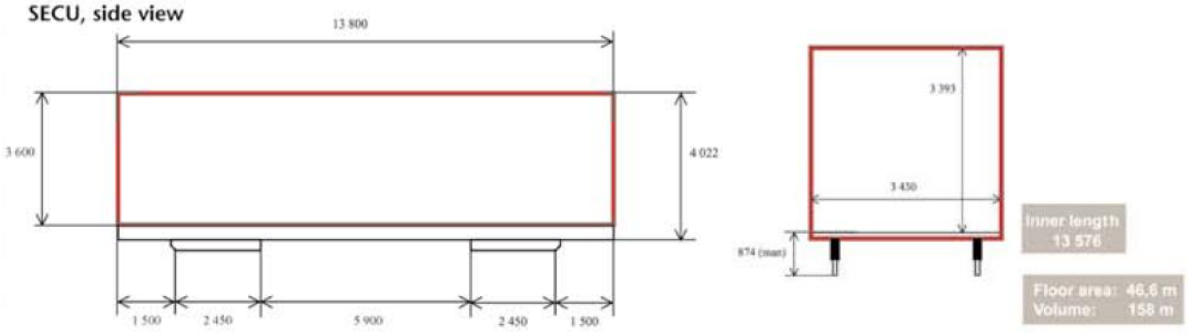
There are two types of SECUs, one for automatic loading/ discharging (grey box) with profiles in the floor and one for conventional loading (red box) for fork lift trucks. The SECUs should only be opened when SECU is on a levelled surface and at intended station sof the terminal.



Source: [4]

Fig. 3: RoRo SECU Carrier and S-borg main deck filled with SECU's

On top of commissioning the new gigant boxes, Stora Enso also ordered three tailor-made ships (from Wagenborg). The vessels are shaped specifically for Secus to maximize capacity and minimize in-transit movement and damage in the hold of the ship. Sea-Ro constructed a double-deck pontoon that would allow the Secus to be driven on and off the ship with minimal disturbance to the reels, while limiting the discharging operations to a maximum of three hours (two decks are discharged simultaneously). [7]



Source: [6]

Fig. 4: SECU side view and internal measurements by door

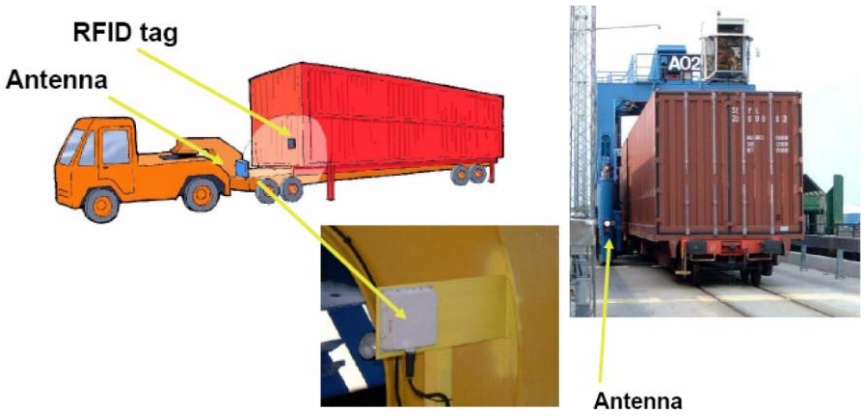
Dimension mm	External	Internal	Door opening		
Length:	13,800	13,576			
Width:	3,600	3,430	3,430	Maximum payload with the SECU positioned on the railwagon.	
Height:	4,375	3,437	3,393	Weight railwagon:	18,400 kg
Rating					Stax 25t
Maximum gross weight:	93,000 kg			Manual:	68,100 kg
Tare weight (manual):	13,500 kg			Automatic:	67,040 kg
Tare weight (automatic):	14,560 kg			Floor strength:	13,0 t axel load
Maximum payload sea:	79,500 kg (man)			Floor material:	Wood
Maximum payload sea:	78,440 kg (aut)			Lashing rings:	Yes
Volume:	160 m3				
Number of Euro-pallets per layer: 44 units					

Source: [6]

Fig. 5: Dimension, Weight and Loading Capacity of SECU

SECU is identified every time in during transport (to ensure safety during transport):

- Readers are installed in tag masters
- Read range about 3 metres.



Source: [2]

Fig. 6: Unit-level identification

Stora Enso is an integrated paper, packaging, and forest products company, producing publication and fine paper, packaging board, and wood products. The main production facilities for the European market are in the Nordic countries. The copany started a drive to, at the same time, improve the environmental performance and reduce cost of logistics operations. In order to achieve a customer demand-driven, quick response logistics operation, Local Distribution Centres have been established close to customers. To service the distribution centres, an integrated logistics solution using the Port of Gothenburg as the main hub was established. [6]

A side effect of using the SECUs, specifically using automatic loading and unloading of the boxes, is increased paper quality. The total number of times the paper rolls need to be handled is reduced, hence the possibilities for inflicting damage during transport. [6]

Source: [4]

Fig. 7: Automatic loading

All vessels used in these operations are based on the concept designed in the EU project IPSI. The cargo holds are completely rectangular and accommodates very efficient cargo handling, including automatic loading and unloading – using RoRo system.

Tab. 1: Usage of Intermodal Loading Units

Transport mode/ Intermodal load unit	Deep sea container vessels	European Container feeder vessels	On deck Reefer and open Hatch	Ro-Ro, RoPax	Rail	Road	Inland waterways
Standard – container	YES	YES	YES	YES	YES	YES	Yes
Euro container	Only latest vessel generation	Partly , but not all carriers	YES	YES	YES	YES	Mostly , but not all carriers
Swap-bodies				YES	YES	YES	
Flat racks	YES	YES	YES	YES	YES	YES	Yes
Trailers				YES	YES	YES	On special dedicated vessels
Stora box				YES	Restricted	Terminals only	
Cassettes				YES	YES	YES	

Source: [6]

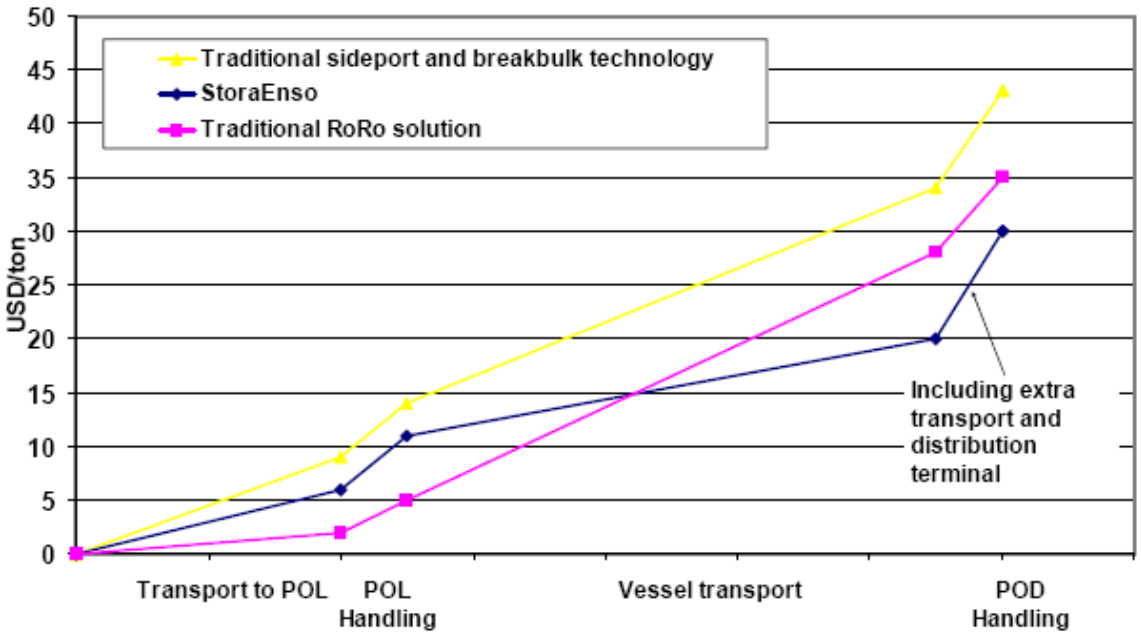
The vessels may efficiently transport different types of load units: SECUs, trailers and a variety of containers and other cargo that may be placed on RoRo cassettes.

Source: [7]

Fig. 8: SECU and RoRo cassette

The advantage of this system is also that the time in port for these vessels is significally shorter than for container feedering vessels (Even though the vessel cost is higher than the cost of container handling). The SECUs are being loaded and unloaded using terminal translifters and tractors. Measurements in the Port of Gothenburg show cargo handling capacity equivalent to 250-400 TEUs per hour. [6]

Important for the lower costs of the ramp (approximately 20% of the cost of a container crane with a capacity of 30 TEUs per hour). The harmonized vessel cargo hold and ramp design facilitates automatic cargo handling using automatically guided vehicles with a potential capacity of more than 1100 TEUs per hour. Alongside the development of the development of the physical logistics operations, Stora Enso has continuously developed their systems for unload or load the boxes. This includes equipping the SECU with smart tags and each paper roll is given a unique identity (tags for the system RFID). Careful planning results in proper utilization of transport resources and smart tags ensure proper tracking and tracing. A number of projects have been carried out to analyse the cost of transport from the Nordic countries to customers on the continent. In the first phase of implementation (serving only the Swedish mills) the following Figure 9 shows significant cost benefits for the Stora Enso solution. [6]



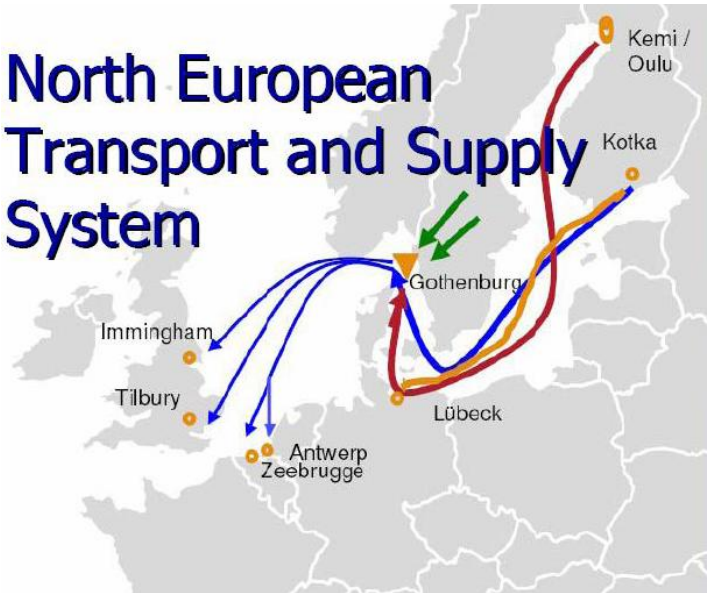
Source: [7]

Fig. 9: Cost benefits for the Stora Enso solution

There is in Scandinavian countries the system NETTS (North European Transportation and Supply System) It is a delivery and transportation system developed by Stora Enso. Its aim is to offer competitive transportation costs to plants operating in northern Finland, to increase the frequency of shipping as well as to improve customer service, minimise damage and develop shipment tracking.

The system comprises 800 SECUs or Stora Enso Cargo Units, and three RoRo container vessels. The first of these, TransPaper, commenced traffic at the end of August 2005. The

destinations of the line traffic vessels are Gothenburg in Sweden and Lübeck in Germany. There are fast connections from Port Gothenburg to Ports of Tilbury and Immingham in England as well as Antwerp and Zeebrügge in Belgium. The maximum joined carrying capacity of the three vessels comes to about 1.5 million tonnes.



Source: [7]

Fig. 10: North European Transport and Supply System

NETSS TransLumi Line from Sweden, which is part of the TransAtlantic group, is the shipping company in charge of the line traffic. One ship can carry about 150 SECUs with a combined total weight on some 13.800 tonnes.

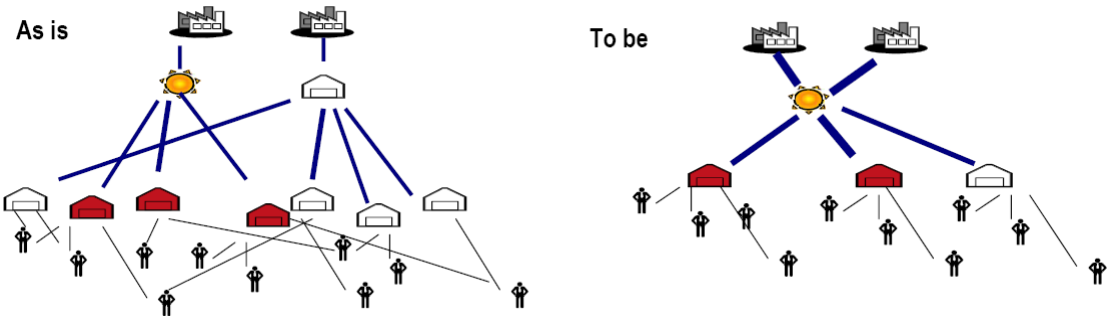
3. Concept for the Baltic Sea region

Baltic corridor is one of the four corridors agreed, in which Motorways of sea projects will be implemented up to 2010. As a geographical area Baltic corridor region is very specific. The corridor covers both the Baltic Sea area and the connecting waterways to the North Sea area. Baltic Sea is an inland sea of EU. Apart from short stretch of the Russian coastline, the Baltic Sea is surrounded only by EU nations. Another specialty is that sea also gets some size of an icecover during every winter. [4]

The economical activity round the Baltic corridor is considerable. In total some 500 million freight tons are carried across this inland sea per year. A majority of this is bulk products, but general goods cover 200 million freight tons. The degree of unitization is high in general cargo traffic. Over 7.5 million containers (TEU) and trailers are carried on sea vessels. Apart from this some 30 million sea passengers cross the Baltic Sea every year. Both cargo and passenger operations suffer in winter from extreme climate conditions which generate extra costs and technical challenges.

The Baltic Sea countries have been active in the concretization of the system of motorways of the sea concept for the Baltic Sea region. A well functioning maritime traffic all year round is of high importance, but not always the case in the Baltic corridor. The most

problem in this area is the ice in Baltic Sea. The Baltic Sea gets an ice every winter. The size of this coverage varies from year to year. In the northernmost areas of the Baltic this problems prevails some 2-4 months every year. In these conditions hundreds of million of freight tons are shifted across the sea. The ice breaking cooperation is an area, in which a joint Baltic Sea approach will give added value and improve the function of winter navigation in the region. Ice creates a major problem for sustainable mobility and an extraordinary cost for both freight transport and passenger traffic. Remembering the high reliance of sea transport – for example 85% of the Finnish foreign trade is carried through maritime access – this ice factor must be considered as a similar bottleneck as the mountain ranges. Especially here the bypassing techniques need EU support and funds. [4]

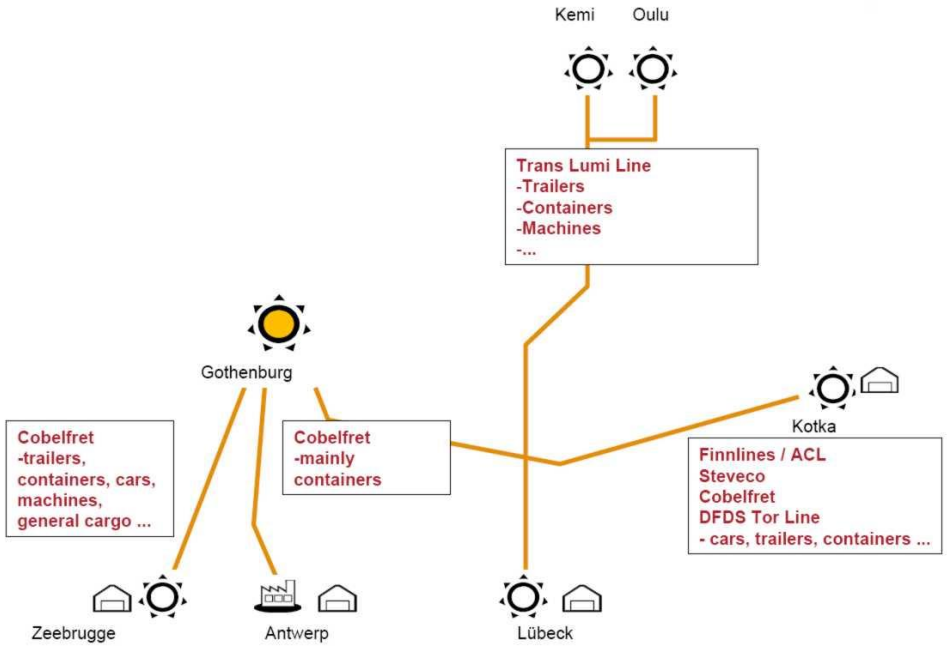


Source: [5]

Fig. 11: The Hub-and-Spoke system

The solution was the Hub and Spoke system which, for instance, both airlines and express courier companies apply. We applied it to maritime sector combining both Finnish and Swedish freight flows for further deliveries and distribution to European ports and customers. Key elements were cargo unitization, improved quality and higher sailing frequency.

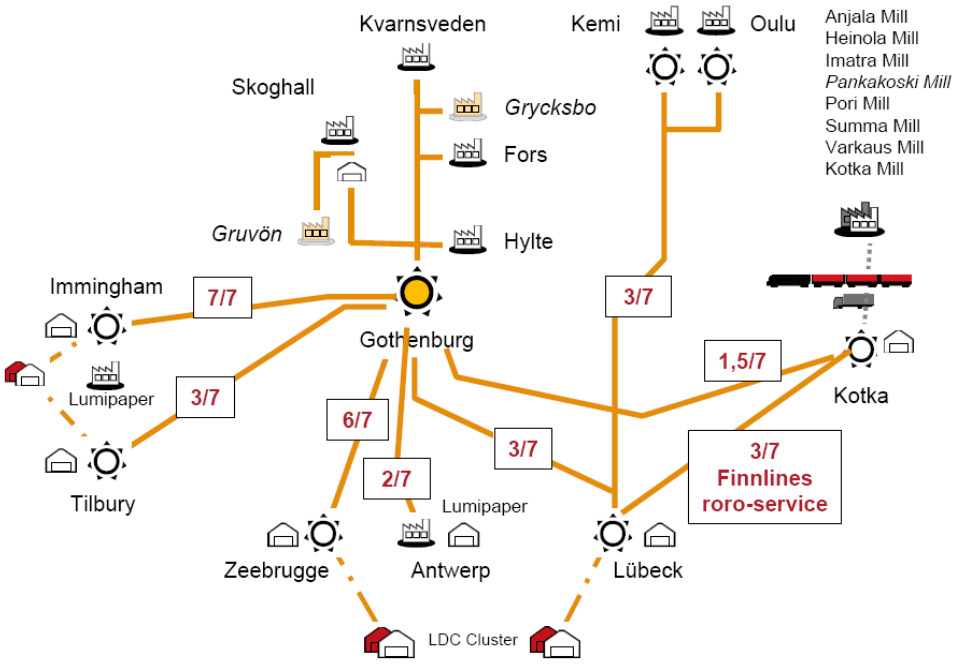
Industry and authorities have invested about 300 million Euros to the structures of system Hub and Spoke model. Operationally the set-up was following. Unitized paper deliveries from Swedish mills via Gothenburg to Continental port started already earlier. In the zdar 2005 was concentrated all Southern Finnish volumes to one feeder line to Gothenburg and added delivery axels to UK ports. In 2006 also Northern Finnish production sites are connected to Gothenburg Hub and a new Spoke to Antwerp will be added. Also it was included Southern Baltic port Lübeck directly into Spoke system.



Source: [2]

Fig. 12: System Hub-and-Spoke

The most important item in this maritime based Hub and Spoke system is the intermodal cargo unit (sea containers). Normal sea containers do not optimally and economically fit into paper transports. Therefore we have developed an own, inter-modal unit design called SECU. It can be carried both on sea and on rail in only Sweden and in Finland.



Source: [2]

Fig. 13: Services Frequency calls per week

Due to high weight of SECU it is handled by bottom-lift- and pull-push-operations. In the Port of Gothenburg (The Hub) the units are discharged form rail with special

straddlecarries. Horizontal movements in the port area or between vessels, in and out, are carried out with heavy tugmasters and translifters. Vessels are fitted with multi-level ramps.

Source: [7]

Fig. 14: Hub – Port of Gothenburg

Main Achievements of this system SECU are:

- Concentrating cargo flows – reducing cost;
- Transferring … tons from road to rail and Short Sea Shipping;
- Reducing lead times;
- Improved environmental performance.

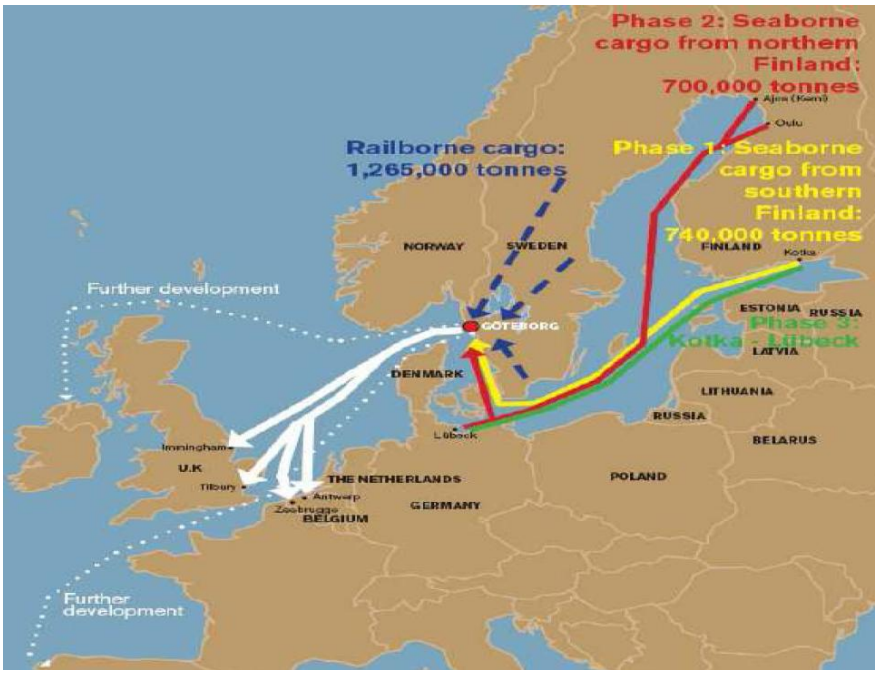
Main Innovations of this system SECU are:

- Density of cargo using the Stora Enso Cargo Unit (SECU) and special rail wagons;
- Cargo handling concept and technology in ports with capacity equivalent to 250-400 TEUs per hour;
- Vessel designs supporting efficient cargo handling;
- Vessel technology reducing emissions.

Swedish mills have been exporting paper on rail via the Port of Gothenburg (Göteborg) for further distribution since 1999. 1.4 Million tonnes per year. There are 6 join per week from Port of Gothenburg to Port of Zeebrügge. All volumes are transported in custom-built boxes. Empty boxes are shipped back to the mills from Belgium via the Port of Gothenburg.

Finnish volumes have been added to the system: South Finland since 2005, North Finland since 2006 as Figure 15 depicts below. In particular, 3 million tonnes are totally added to the system. Finnish volumes are shipped by RoRo-ships in SECU boxes and transhipped in Gothenburg. Immingham and Tilbury in England (UK) are added destinations. Stora Enso builds high-bay warehouse in Tilbury. Overseas containers are added to the system from North Finland for loading on container ships in Göteborg. Contract is long term

and exceeds the15 years. All in all, about 4.5 million tonnes of Stora Enso paper is handled in the Port of Gothenburg hub in 2006.



Source: [5]

Fig. 15: Phases and Volumes of both Sea-borne and Rail-borne Cargo

On year 2007 The Port of Luebeck and ECL mbH (European Cargo logistics) was introduced and started operations.a brand new paper handling system for forest products, developed in close cooperation between the companies Stora Enso, The Port of Luebeck. The paper concern Stora Enso have commissioned and authorized ECL to carry out the entire disposition for ongoing transport in Germany and abroad.

Source: Port of Lübeck

Fig. 16: The paper handling system at the Nordlandkai Lübeck

Results

The SECU is the traffic solution has been a great success. Despite the fact that Stora Enso is using the very large containers (SECU boxes), the port terminals and the ships are generic and can support any cargo that can be placed on RoRo cassettes. The system is robust and reliable and has proven to provide a solution for the short sea shipping operation that should be a model for future EU developments in the area of concept of motorways of the Sea (especially Baltic Sea).

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