



INTERMODE-TRANS
TSA3-CT-2004-003760

Specific support action for pan-European stakeholders and users sustaining integrated pilot technologies for increasing the efficiency of intermodal transport

Deliverable D2.1

State of art on intermodal transfer techniques

Report Version: V1.0

Classification: Public

Report Preparation Date: 24/1/2005

Contract Start Date: 01-Nov-2004

Duration: 18 months

Contract Finish Date: 30-Apr-2006

Project Coordinator: METTLE

Partners:

METTLE	France	Catracom	Belgium
University College of Borås	Sweden	Grimaldi Group	Italy
Kocks Krane International	Germany	Pañalon	Spain
Volvo Technology Corporation	Norway		



Project funded by the European Community under the Sixth Framework Programme, Sustainable Development, Global Change and Ecosystems. Research Directorate - General

DELIVERABLE SUMMARY SHEET

Deliverable N°:	D2.1
Due date:	Month 3
Delivery Date:	24/01/2005
Classification:	Public

Short Description
<p>The present report is a first state-of-art survey on the perspectives of intermodal transport. Being seen by several stakeholders, including the European Commission, as a remedy to environmental and energy supply issues associated with the present and forecasted volume of road transport, several initiatives and joint European projects have been launched to support a modal shift. The report gives a review and summary of the results of such projects and points out a number of remaining barriers to a general acceptance of intermodality, including several of a technical or technological character, pertaining to transshipment procedures, multimodal cargo units, safety and security concerns and information processing.</p> <p>A series of workshops throughout Europe during 2005 will elaborate on intermodality and provide further background for an updated and amended report to appear later in 2005.</p>

Authors	
Name	Company
Peter Andersson	Högskolan i Borås
Daniel Ekwall	Högskolan i Borås
Håkan Torstensson	Högskolan i Borås

Internal Reviewing/Approval of report			
Name	Company	Approval	Date
Juan Marcos Montero	PANALON	Approved	01/02/2005

Document History					
Revision	Date	Company	Initials	Revised pages	Short description of changes

DISCLAIMER

Use of any knowledge, information or data contained in this document shall be at the user's sole risk. The members of the INTERMODE-TRANS Consortium accept no liability or responsibility, in negligence or otherwise, for any loss, damage or expense whatsoever incurred by any person as a result of the use, in any manner or form, of any knowledge, information or data contained in this document, or due to any inaccuracy, omission or error therein contained.

The European Commission shall not in any way be liable or responsible for the use of any such knowledge, information or data, or the consequences thereof.

Contents

1.	Introduction	1
1.1.	<i>Intermode-TRANS project summary</i>	1
1.2.	<i>Objectives of the project Intermode-TRANS</i>	1
1.3.	<i>Background to intermodality</i>	2
1.4.	<i>Limitations</i>	Error! Bookmark not defined.
2.	Intermodal transport	4
2.1.	<i>Definitions of modality in transport</i>	4
2.2.	<i>Strengths and weaknesses in different modes of transports</i>	5
2.3.	<i>Opportunities with intermodal transport</i>	5
3.	Trends & on-going projects	7
3.1.	<i>General trends in logistics</i>	7
3.2.	<i>Trends in intermodal transport</i>	8
3.3.	<i>EU-funded research and development projects</i>	9
3.3.1	Introduction and summary	9
3.3.2	FLIHIT, Flexible Intermodal Horizontal Transshipment Techniques	10
3.3.3	IPSI, Improved Port/Ship Interface	11
3.3.4	INTEGRATION, Integration of Sea Land Technologies for an Efficient Intermodal Door to Door Transport	12
3.3.5	EMOLITE, Evaluation Model for the Optimal Location of Intermodal Terminals in Europe	14
3.3.6	IMPULSE, Interoperable Modular Pilot Plants Underlying the Logistic Systems in Europe	14
3.3.7	SIMTAG, Safe InterModal Transport across the Globe	15
3.3.8	ASAPP, Automated Shuttle for Augmented Port Performance, ASAPP-ONE, Intelligent Shuttle Fleet connecting a Split Container Storage Area for Intermodal Operation Improvement	16
3.3.9	INHOTRA, Interoperable Intermodal Horizontal Transshipment	16
3.3.10	INFOLOG, Intermodal Information Link for Improved Logistics <i>and</i> D2D, Demonstration of an Integrated Management and Communication System for Door-to-Door Intermodal Freight Transport Operations	17
3.3.11	INTRARTIP, Intermodal Transport Real Time Information Platform	18
3.3.12	SPIN-HSV, Shipping Quality and Safety of High Speed Vessels, Terminals and Ports operations in Nodal Points	18
3.3.13	REALISE, Regional Action for Logistical Integration of Shipping across Europe	19
3.3.14	IQ, Intermodal Quality	20
3.3.15	LOGIQ, Intermodal Decision (the decision making-process in intermodal transport)	20
3.3.16	IDIOMA, Innovative Distribution with Intermodal Freight Operation in Metropolitan Areas	20
3.3.17	CARGOSPEED, Cargo Rail/Road Interchange at Speed	21
3.3.18	TACTICS, the Automated Conveying and Transfer of Intermodal Cargo Shipments	22
3.3.19	ROLLING SHELF, Palletised Rail Goods	22
3.3.20	TERMINET, Towards a New Generation of Networks and Terminals for Multimodal Freight Transport	23
3.3.21	X-MODALL, the Optimisation of Modular Intermodal Freight Systems for Europe 2000+	23
3.3.22	INTERMODESHIP, the Intermodal Ship	24
3.3.23	GIFTS, Global Intermodal Freight Transport System	24
3.3.24	EUTP II, Thematic Network on Freight Transfer Points and Terminals	24

3.4.	<i>Technologies in intermodality</i>	24
3.4.1	Small-scale road-rail solutions	25
3.4.2	Large-scale road-rail solutions	26
3.4.3	Road-rail-sea solutions	26
3.4.4	Road-rail-air technologies	27
4.	Present state of intermodal transport in the EU	28
4.1.	<i>Motorways of the Sea</i>	28
4.2.	<i>Harmonisation of containers and other cargo units</i>	30
4.3.	<i>Freight Transport Management Systems</i>	31
4.4.	<i>Economic impact of carrier liability</i>	31
4.5.	<i>Security and safety</i>	32
5.	Conclusions	33
5.1.	<i>Obstacles to freight intermodality</i>	33
5.2.	<i>The role of information technology</i>	33
5.3.	<i>Measures of performance</i>	34
5.4.	<i>Items to be addressed in the Intermode-TRANS project</i>	34
6.	References	38

1. Introduction

1.1. Intermode-TRANS project summary

The importance of transport technologies and transshipment tools and equipments which are not yet optimised for goods handling and moving will become even more critical with the enlargement of the European Union to Eastern Europe that will shift transport demand to/from the accession countries. It is critical to raise awareness and come to an efficient solution as soon as possible so as to decrease potential points of friction and costs.

The main problems that will be addressed in the specific support action Intermode-TRANS are:

- Incompatibility between the different available technologies and tools.
- Incapacity of the different terminal technologies to cope with the increased demand of transport.
- Standardisation and interoperability of transport technologies which are not actually optimised for easy handling and moving of goods.

The Specific Support Action Intermode-TRANS will target ongoing research and development with regard to transport technologies that can achieve a sustainable modal shift from road to railways and waterborne routes including inland navigation and short sea shipping, promoting the development of transshipment technologies, tools and equipments based on the real need of the end-users.

This will be done through an interaction among transport operators, engineering companies and manufacturers of transshipment technologies. The research and dissemination will also give a specific attention to target SMEs and participation of new member countries through several workshops used to gather information.

Therefore, one of the key aims of Intermode-TRANS is to provide a platform among manufacturers, engineering and transport operators. The dynamic platform will then generate RTD guidelines for innovative technologies for intermodality.

Within the dynamic platform, a second objective is to prepare the ground for future RTD activities within and beyond FP6 by networking and creating constituencies of technologies' suppliers and stakeholders in order to investigate future research challenges and associated implementation models. The project will contribute to the implementation of activities of the work programme for sustainable surface transport. (Intermode-TRANS, 2004)

1.2. Objectives of the project Intermode-TRANS

The objectives of Intermode-TRANS will address the following problems:

- Development of efficient and standardised intermodal technologies and transshipment solutions.
- Role and benefits for SMEs in general and with special consideration of Candidate Countries and new Member States.
- Incompatibility between the different available technologies and tools.
- Incapacity of the different terminal technologies to cope with the increased demand of transport.

1.3. Background to intermodality

Transport as a key element of the worldwide economies will face a number of challenges in the forthcoming years. There are many good and well documented reasons to presuppose that a modern transport system must be sustainable from an economic, social and environmental point of view. Any future plans for the European transport sector have to take into account the economic importance with a contribution to the European GDP of more than 10 %. But still the transport market is not harmonised which becomes visible by the increasing congestion in Europe. Further globalisation and general economic growth will lead to ever increasing transport demand. The enlargement of the European Union will create additional transport needs. So it is forecast that unless major new measures are taken, by 2010 heavy goods vehicle traffic alone will increase by nearly 50 % over its 1998 level. The expected growth in transport demand may very likely lead to a collapse of the system. Therefore, a fast solution is necessary in order to anticipate such a collapse of road transport.

Logistics channels that are more global also require multi/intermodal transport chains. Intermodality is at the core of most advanced logistics strategies used by the major transport companies in the world. Intermodal management responds to the challenges faced by logistics service providers. The coordination of production and distribution in an integrated process is becoming of strategic importance to many companies. The transport service providers must be able, first and foremost, to provide a timely, cost effective, high quality service to their customers and therefore operate in an intermodal environment. Clearly, the terminals for transshipment between modes are becoming increasingly important.

Recent analyses have provided an overview of the requirements shippers have with regard to the use of intermodal transport. The most important points are speed, short running times, organisation of a door-to-door chain, punctuality, schedule keeping and flexibility. At the same time the shippers expect the following advantages from intermodal transport use: reduction of environmental damages, reduced road congestion, increased speed as well as micro-economic advantages.

Obviously the potential for a modal shift is very large, as shown in a statistical study within the TRILOG Europe project (Henstra et al., 2000). It was found that only 7.5 % of all transport work in the European Union (1996, EU-15) is carried out intermodally, mainly in short sea shipping combinations. Road-rail intermodality had then a market share of 2.7 %. There are differences between the countries and regions of Europe, often due to geographical conditions. Thus Austria and Switzerland, with the alpine transit, and Sweden, with the long distances, have a clearly larger percentage of rail transport, and the Netherlands stand out regarding inland waterway transport.

The European Task Force on Transport Intermodality provided the following explanation, regarding the economic, social and employment impacts of intermodality: “The objective of promoting intermodality in the first place is to achieve a better use of existing capacities and infrastructures, notably in rail, inland waterways and short-sea-shipping. The efficiency of road haulage, on which a majority of industries currently rely, is being eroded by congested roads.”

The cost of road congestion was estimated to 120 billion ECU per year, equivalent to 2% of Europe’s GDP. Improved efficiency in the transport system will positively help Europe’s competitiveness at a global level and, eventually, the European consumer.

“But equally important is the fact that we want to promote the use of more environmentally-friendly transport modes, by unlocking and improving their economic

potential. So intermodality serves our goal of ensuring sustainable mobility in the future and is complementary to our other policies, such as the promotion of fair and efficient pricing. More intermodal transport will undoubtedly bring environmental as well as safety benefits for the citizen.”

“The transport sector makes an important contribution to GDP and is a very large employer - this will continue without any doubt. But there will be a gradual restructuring of the workforce in transport. The required qualifications and competences will gradually change from an industrial type of employment to a more service- and information-oriented environment.”

“A full implementation of our action programme for intermodality could result in the creation of more jobs in the supplier industry: for making new equipment and means of transport and especially for implementing and maintaining new information technologies and services. The integration of transport and logistics services could also create new employment opportunities, for example at big intermodal hubs which could become centres of economic activity.”

Several projects in previous research programmes have addressed the issue of intermodality and transshipment and there is a lot of expertise available in the European research environment.

2. Intermodal transport

2.1. Definitions of modality in transport

There are several interpretations and definitions of intermodality and each one has its merits. To make this report more precise it is important to first define some common concepts. The terms that need to be defined are intermodal, multimodal and combined transport.

Intermodality has been defined by the European Commission as “a characteristic of a transport system whereby at least two different modes are used in an integrated manner in order to complete a door-to-door transport sequence”. The resultant global approach enables the available transport capacity to be used more rationally.

Intermodality should be understood as an integration of all modes, i.e. road, rail, inland waterways, short sea shipping, ocean shipping, air transport, pipelines. All these elements of the transport system have to be integrated into seamless door-to-door transport chains. The European Conference of Ministers of Transport (ECMT) has established a widely used technical definition of intermodal freight transport, which is limited to the transport of units of regular size. It has also Unitization is important to facilitate the transfer of goods between modes, but it is only one possible development.

Thus the concept of intermodality should not be limited to unitised transport. The growing trend of outsourcing of logistics activities by industry means that goods can undergo an economic process at some point during the transport chain, principally at a terminal. This could be an important strategy to make intermodal transport competitive, namely by providing added value to the entire supply or distribution chain. But this means that the goods cannot remain in their containers during the whole journey. The intermodality concept applies both to freight and to passenger transport.

ECMT also defines multimodal transport: *Multimodal* transport only describes the carriage of goods by least two different modes of transport, whereas intermodal transport refers to the transport of goods in one and the same loading unit using successively several modes of transport. Although *combined* transport is based on intermodal transport, it is characterised by two very important supplement items; the major part of the journey is by rail, inland waterways or sea and any initial/final leg carried out by road is as short as possible (ECMT, 1996, website).

With this definition as a complement to the definition made by the commission it is easy to distinguish between multi- and intermodal transports. The main difference is that *intermodal* transport implies the use of a single load unit to simplify the loading, reloading and unloading processes in all parts of the transportation, while *multimodal* only points out that more than one mode of transport is involved in the delivery. The last part of the ECMT definition leads to the term of combined transport, which is in this sense a special type of intermodal transport, where the major part of the transport chain is carried by another mode than road, but the first and the last part of it is made by road.

In this report we use the term *intermodal transport* in the same meaning as *combined transport* in the ECMT definition, but as discussed above we also go beyond the requirement of having one and the same loading unit throughout the transport chain.

2.2. Strengths and weaknesses in different modes of transports

Road: In short or middle-range distance delivery road transport is the most flexible and fastest way to perform the door-to-door transport. The market for road transport has evolved fast in recent years and the competition has put a pressure on prices and flexibility. If this development continues, there is a risk that the motorways in central Europe will lack the capacity to accommodate all trucks. The environmental strain generated by the increasing road transport is also a problem with this mode.

Rail: The rail system was developed within and by the national states at the end of the 19th century. It is therefore still struggling with much incapability, created on purpose at that time. These problems have been reduced greatly, thanks to different initiatives, taken by both the EU and its member states, to simplify the use of rail transport across borders.

Sea: In long distance and large volume transportation there is no real competition with sea transport. Only if the goods are valuable or are in extreme hurry, airfreight can be a serious competitor. The base of efficient sea transport is the standard load unit, in particular the ISO container series. All major ports are today planned to receive increasingly larger volumes of containers each year. Over 90% of all world cargo moves by container. One problem with ISO containers is the different regulations on maximum external dimensions in road transport that apply in different countries.

Inland waterways: The main objective of inland waterway transport is to carry bulk products where speed is not a concern.

2.3. Opportunities with intermodal transport

Intermodal transport in Europe is on its way to a second revolution. Through cooperation, new thinking and long term strategy it can finally challenge road transports. To make this come true will however require extensive investments in both technology and information systems. The main factors in favour of intermodality, apart from the prospects of less congestion and beneficial effects on energy use and environmental impact, are the trans-national refurbishment of the rail systems, the development of information systems and the quality and market orientation of the supply (or demand) chain.

The change in the rail system in Europe is caused by a new logistics paradigm. The users ceased thinking in terms of shipments and started to think in terms of flows, constant flows of recurring shipments, time table controlled flows and demand on delivery within a certain time frame. Nowadays the business plans for complete supply networks where raw material, components and finished products are transported along well-defined supply chains.

This change can also be described as a change from production-oriented to performance-oriented logistics through a number of intermediate steps. It has also led to that the traditional view on transportation services has become more imprecise, and the competition between modes of transports has been replaced by a market for logistics services, which uses a sophisticated integration of several modes of transports.

A great possibility for intermodal transports is the creation of cargo centres – gateways – outside every major city in Europe. This logistic function is due to restrictions regarding weight and/or length of road vehicles and the demand for city distribution at night in a combined effort to reduce congestion in daytime traffic. The long distance

transport will be focused on the links between these gateways which makes rail and inland waterways more competitive even at mid-range distances (Woxenius 2003). An application of the gateway concept is the dry port idea.

3. Trends & on-going projects

3.1. General trends in logistics

There are some general trends in logistics, which have a crucial influence on intermodal transports. Here some of them are presented and their implications for intermodal transport highlighted (Woxenius, 2003).

Concentration of flows: More cargo and longer distances mean increased opportunities for intermodal transports to compete with road transport (positive).

Larger geographical areas for purchase and distribution: Increased transport distances make intermodal transport more competitive (positive).

JIT, quick response, time windows: Higher demand of transport quality (speed, reliability, flexibility, information support, low frequency of damage), which is difficult to meet in intermodal transport (negative).

Increased vehicle size: Increased productivity for road transport (negative) but also increased efficiency in intermodal transport, including more efficient use of load profiles for railways (positive).

Better information systems: Better ability to coordinate and improve services for both road and intermodal transports. Better ability to control and coordinate intermodal supply chains (positive).

Congestion in road traffic: Decreases transport quality of road transport and increases the need for political actions (positive).

Outsourcing of production: Increased possibilities to coordinate shipments and thereby increasing the loads in the system (positive).

Political actions to stimulate intermodality: Favourable pricing and public infrastructural investments will improve the competition for intermodal transport (positive).

Increased direct distribution: Smaller loads and higher delivery frequency lead to a need for more flexibility in the logistics system (negative).

Increased complexity in the logistics system: Greater need for flexibility in transportation which leads to more road transport (negative).

Development in exhaust emission control and alternative fuels: Cleaner road transport will reduce the environmental benefits of intermodality, but intermodal transport will also become cleaner.

Increased environmental awareness of end users: The environmental aspects may make transport buyers choose intermodal transport instead for road transports (positive).

Increased quantities in transportation: More cargo in the system leads to a greater need for links with higher capacity, unsustainable road transport if increased, and more economical use of alternative modes (positive).

Comprehensive trends are that the volume and the distance both will increase and that there will be better opportunities to make intermodal transport more competitive in comparison with road transport. This needs extensive investments in both technology and information systems for intermodality.

3.2. Trends in intermodal transport

The major trend in intermodal transports is the same as in the logistics business in general, integration and consolidation of the companies from several to a few. This means that all of the large logistics companies are intermodal in their composition and able to conduct intermodal transports from door-to-door within the company. To be able to accomplish this, companies have invested in information systems and new terminal solutions to improve their ability to compete on a deregulated market. As a complement to the development by the operators in the logistics market there are some trends in intermodal transportation, which can be categorized as geographical, technological and political, depending on their main focus (Woxenius 2003).

Geographical trends: The primary driving force behind this is that the manufacturing facilities become more and more specialized and/or that they are moved to emerging sourcing countries. The need for transportation capacity has increased, which leads to a better competitive situation for intermodal transports. To meet this demand the business has acquired larger container-ships and bigger terminals and established high-volume links between inland terminals. In a European view the volume increase will presumably lead to the need for development of cargo-highways based on railways. The great problem here is the main internal European transport market is in short and middle range transport. So the main challenge for intermodal transport is to be a strong competitor to road transport at distances down to 250 km.

Technological trends: Some of the greatest problems for intermodal transports in Europe to seriously challenge road transport are of a technological nature. The lack of an all-over-Europe functional standardized single load unit must be solved. The trend in this area is that the use of containers is increasing. The use of lorries for container transport is also increasing. In the future hopefully all modes of transport can use the same standardized single load unit, which would speed up and simplify all terminal work in an intermodal transport. These stand-alone standardized single units would make all marshalling redundant, making railway terminals become more like a seaport in facilities and equipment, where the freight train has the same role as a container ship.

Political trends: The main contradiction in intermodal transport is that it is beneficial for national economics but disadvantageous for business economics. By changing the rules and regulations associated with intermodality in the European Union this problem can be reduced. The congestion of highways in central Europe is one political problem that can partly be handled by having the cargo transported by rail or inland waterways. Clearly the EU is an important driving force in the development of an integrated European transport system, with instruments such as support for infrastructure development, coordination of national regulations, directives for competitive combined transport, an emphasis on the necessity of intermodal transport solutions to ease the burdens of the increasing road traffic from environmental, resource-conserving, and time-saving points of view. This is also supported by a number of initiatives, such as TEN (Trans-European Networks), the White Paper on transport policy until 2010, the programmes Marco Polo and its predecessor PACT (Pilot Actions on Combined Transport), the established Task Force on Intermodality, the Strategy for revitalizing the community's railways and more. The European Commission has also accepted the view

of the European Council from the Gothenburg summit 2001 that economic growth should be decoupled from an ever increasing transport volume.

However it can be noted (Woxenius 2003) that due to the subsidiarity principle the EU initiatives may not reach the most critical transport categories, the mid-range distances of 250-500 km, usually within individual countries, where the competitiveness of intermodal solutions is very weak.

In intermodality there are four categories (production solutions) of development to make it a serious competitor to road transport (Woxenius 2003). These four categories can and must coexist and they need coordination to become successful:

Large flows over long distances: This is the intermodal concept at its best. Entire train sets connecting terminals several times each day will both bring speed and capacity to this production solution.

Large flows over short distances: There are two problems with this production solution, the first is that the frequency of transportation must be very high to compete with road transport, the second is that the distance between terminals must be relatively short and that the train must be able to accomplish many short stops at these terminals. When combined with the production solution *large flows over long distances*, it forms an intermodal network that is rapid and can handle large amounts of cargo.

Small flows over long distances: Small flows are disadvantageous for intermodality, but over longer distances intermodality, combined with corridor flow and larger volume on parts of the distance, can still be competitive.

Small flows over short distances: The most difficult of all production solutions. Intermodal transport has a higher fixed cost than road transport and in the case of small flows these costs cannot be shared by enough shipments to be competitive with road transport.

3.3. EU-funded research and development projects

3.3.1 Introduction and summary

There are several projects carried out, or being in progress, concerning intermodal transports. The projects in this survey cover domains as technical solutions, IT systems, market and policy analyses etc.

Concerning technology only a few projects have been implemented or are under evaluation. The INHOTRA (INHOTRA, website) project is implemented by Rail Cargo Austria. The IPSI (IPSI 1, website) project led to the INTEGRATION (INTEGRATION 2, website) project and appears promising as it utilizes the most widely used cargo containment units. It has similarities with the ASAPP-ONE (ASAPP-ONE, website) project as both use automated guided vehicles for transportation of cargo units between a port and a terminal. The difference is that INTEGRATION also evaluates new vessels for optimal performance. Both of these may contribute to raising the efficiency of smaller ports, making them an interesting alternative to high capacity ports. SPIN-HSV created several reports usable for the high speed vessel market, including a reference model for ship-shore relations. However the project stated that high speed vessels have a low impact on the transport sector due to high operating costs.

Regarding IT systems the D2D (D2D, website) project, using results from the INFOLOG (INFOLOG, website), INTRARTIP (INTRARTIP, website) and several other projects, can show interesting results in the future. It is based on a data model, TRIM, used by several other projects, which gives possibilities for an open architecture. Standardised interfaces are to be used to promote interoperability with legacy systems and commercial information providers in the road, rail and waterway segments. GIFTS (GIFTS, website) is a similar project to D2D, as it includes the full intermodal chain, as well as e-commerce solutions, whereas SIMTAG (SIMTAG, website) is more aimed towards safety and security.

Several projects have created analysis and simulation tools during their lifespan. EMOLITE (EMOLITE, website) defined a framework and a prototype, usable for simulation of terminal location and LOGIQ (LOGIQ 1, website) developed a decision support tool for assistance in company decisions regarding investments. The importance and usability of their findings are vague. Much work has also been conducted analysing statistics and creating meeting places for actors in the segment of intermodal transport. The outcome from REALISE (REALISE, website), IQ (IQ, website) and EUTP II (EUTP II, website) can undoubtedly contribute with important information in future research projects.

Other projects have developed new intermodal equipment, giving positive test results, but most likely have been seen as not commercially viable. It seems hard to introduce a new concept (e.g. new rail-wagons, transfer equipment and new cargo units) as the operators are unwilling to make such investments.

IMPULSE (IMPULSE, website) demonstrated the possibility for fast loading/discharge of goods from a moving train. Projects as FLIHTT (FLIHTT 1, website), TACTICS (TACTICS, website), TERMINET (TERMINET 1, website), ROLLING SHELF (ROLLING SHELF 1, website) and X-MODALL (X-MODALL 1, website) have attempted to introduce new equipment, without viable results. The future will indicate, whether CARGOSPEED (CARGOSPEED 1, website) will meet the same fate. The same can be the result of INTERMODESHIP (INTERMODESHIP 1, website) but it may become more promising, as more vessels may be needed if a modal shift to waterborne transport occurs.

One problem for the adaptation and implementation of new technology, particularly for rail transport, is the lack of standardisation between different networks and countries. If an actor shall invest in new technology, it has to be widely adapted and usable in several links, not just a specific solution for one link. Here the European Commission can contribute by active participation concerning recommendations and standardisation.

3.3.2 FLIHTT, Flexible Intermodal Horizontal Transshipment Techniques

The FLIHTT project was aimed against horizontal transshipment techniques for combined transports using containers, swap-bodies and semi-trailers (FLIHTT 1, website). The targets of the project were to:

- investigate various alternatives and to confirm the validity of the horizontal transshipment techniques for combined intermodal freight traffic;
- introduce innovations for the load units improving transport cycle automation;
- study the characteristics of exchange points in terms of the best lay-out mainly for two applications:
 - inside the existing terminals / hubs it will be possible to provide specialised areas;

- in the existing goods yards area, it will be possible to convert, partially or totally, the use of the area in terms of combined transport.
- To reduce cost break-even for the combined techniques below 200 Km. (today 400-500 Km.)
- To give more opportunities to the market in terms of flexible and low cost techniques with the aim to transfer major goods traffic volumes towards the use of combined techniques.

The results include development for new loading and unloading equipment, which is used in the TRAI 2000 project in Italy as well as proposal of new rail wagons (FLIHTT 2, website).

The TRAI 2000 system shall be compatible compatibility with road transport and its logistics, with air transport, and with vertical intermodal transport (FLIHTT 3, website).



The TRAI 2000 system, a horizontal transshipment system, compatible with most terminals and permitting easy and economic automation

3.3.3 IPSI, Improved Port/Ship Interface

The IPSI Project was concerned with the development of a flexible port/ship interface concept as a tool to verify the effectiveness of multimodal, door-to-door cargo movements using waterborne transport in Europe, in particular short sea shipping and inland navigation.

The goals of the IPSI project (IPSI 1, website) was to

- develop a concept for flexible port/ship interfaces in the context of added value, intermodal door to door (where applicable) logistics in Europe, based in increased use of waterborne transport, including utilisation of inland waterways
- develop methods and equipment for effective transfer of cargo and information about cargo in the above mentioned land/water interfaces, with focus on high efficiency and low investments
- demonstrate the "new port/ship interface concept" to verify the effectiveness of multimodal cargo exchange in a "door-to-door" context.

The IPSI concept (IPSI 2, website) includes an IPSI Terminal with capability of

- serving high speed short sea shipping lines
- serving feeder service from smaller ports to high capacity ports
- serving inland waterways, including rivers and canals
- handling the most widely used cargo containment units as ISO-containers, road vehicles, swap-bodies and heavy-duty cassettes.

by keeping investments in permanent infrastructure to a minimum.

The consortium's solution is a RoRo alternative, using cassettes transported by an Automatically Guided Vehicle (AGV) who loads/unloads the IPSI vessel. The AGV was demonstrated at the RoRo 2004 exhibition in Gothenburg.



Two containers on a cassette transported by an AGV



View of a harbour fully equipped for loading/unloading with AGVs in the IPSI system

To be able to secure cargo in containers an automated system for lashing is developed. It contains of a rubber sack mounted in the roof of the container that will be filled with compressed air from a high pressure pump. When the sack is filled it secures the goods inside the container.

The INTEGRATION project is based on the findings from the IPSI project and will set up three test sites: a transshipment terminal (Gioia Tauro), a Ro-RO terminal (Genova) in the Mediterranean Sea, and a RO-RO terminal (Gothenburg) in the North Sea.

3.3.4 INTEGRATION, Integration of Sea Land Technologies for an Efficient Intermodal Door to Door Transport

The aim of the INTEGRATION project is to improve the integration and validation of critical technologies already developed in a single approach from ship to shore and in ports (FLIHTT 2, INTEGRATION 1, websites). It is based on the results from the IPSI project.

The solutions are selected in a context of environmental sustainability and safety. INTEGRATION systems shall contribute to increase the competitiveness of the waterborne transport in the intermodal chain through (INTEGRATION 2, website):

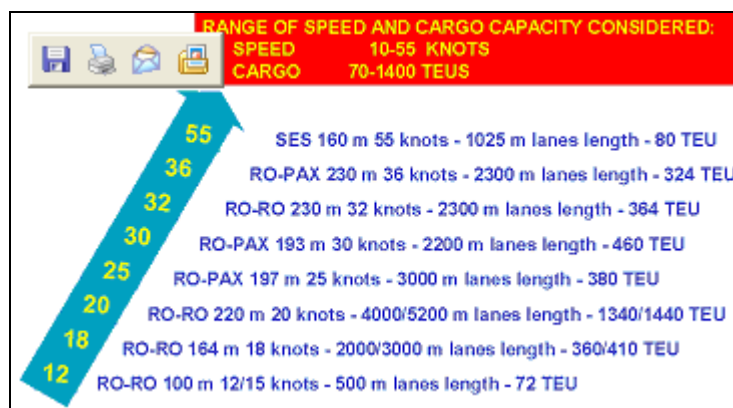
- increased short sea shipping freight transport;
- increased terminal/ports operations volumes;
- enlarged maritime transport network;
- re-equilibrated modal split.

One of the main objectives of the project is the identification of new ship concepts, facilitating integration into the multimodal transport chain, with a specific main aim in reducing loading / unloading time.

3.3.4.1 Vessel design

Important considerations during vessel design are:

- high and articulated capacities of loading / unloading
- flexibility regarding types of cargo (trucks, pallets, containers, general cargo)
- extreme efficiency in port manoeuvring
- technology for low manning
- equipment and materials for reducing environmental impact
- lower maintenance costs
- low building and operational costs
- low energy consumption per transported cargo volume



Identified Range of Vessels

3.3.4.2 Cargo Handling Technologies

Concerning Cargo Handling Technologies, the most relevant achievements expected for INTEGRATION are:

- Ro-Ro & high capacity loading systems; 250-400 TEUs per hour using conventional handling and 400-1200 TEUs per hour using automatic handling with innovative AGVs vehicles
- Horizontal transshipment systems to shift cargo among land vehicles: train, AGVs, trucks, to increase operation efficiency and ship/rail interoperability
- Highly efficient connection to "dry ports" by using an innovative unmanned automated railway vehicle to move cargo between two different terminals (i.e., 1 port + 1 dry port, or 2 dry ports), less than 20 km away from each other.



AGV, Automatic Guided Vehicle

3.3.4.3 Door-to-Door Intermodal Systems

For evaluating door-to-door cargo transport simulations will be performed. These simulations will be useful to evaluate how the innovative suggested solutions might impact on the whole intermodal transportation system, pointing out possible bottlenecks and inefficiencies. Also economic evaluations could be performed through these simulations. The results of these simulations will be evaluated and compared to similar transportation chains considering current transport alternatives.

3.3.5 EMOLITE, Evaluation Model for the Optimal Location of Intermodal Terminals in Europe

The goal of this project was to develop a selection and evaluation model, a decision support system, for the location of intermodal terminals (EMOLITE 1, website). The model will allow an accurate evaluation of potential sites for the development of freights and passengers terminals in Europe taking into account the dynamic and continuously changing transportation market.

EMOLITE has defined the framework for a PC-based decision support system that provides comprehensive strategic information on the quality and suitability of potential terminal locations. Based on this, it has produced the prototype of user-friendly software (implemented in MS Access) that consists of a database and a simulation module, with the following characteristics (EMOLITE 2, website):

- ranking of alternative terminal locations according to weighted values and criteria, for pre-defined classes (cost, flexibility and reliability), attributes (link to the class) and objects;
- flexibility in handling terminal attributes;
- algorithms for solving the rating and ranking based on a fuzzy multiple attribute model;
- an interactive and user-friendly interface, by providing wizards that help to define the framework of transportation and criteria;
- inclusion of visualisation and presentation features, such as charts, reports, graphs and maps.

3.3.6 IMPULSE, Interoperable Modular Pilot Plants Underlying the Logistic Systems in Europe

The main goal (IMPULSE, website) of the IMPULSE project was to:

- analyse requirements for integrated terminals and rolling stock in terms of prime elements (market forces, Trans European Network effects, transport modes, intermodal transport units and trunk haul production forms), measured against pertinent criteria including cost effectiveness, interoperability, modularity, availability and reliability,

- modify and harmonise existing advanced intermodal terminal technology in use at pilot installations to fit the results of the initial analysis and meet the requirements of the key objective,
- test the installations and demonstrate their impact on socio-economic parameters including network operation, intermodal break-even distance, value added services, human behaviour, regional transport flows and environmental conditions,
- provide additional recommendations for future policy on intermodal transport.

The analysis of the requirements showed that gauge, electrification and signalling systems are still diverging between different railway networks, thus being a source of additional delay.

For improved information flow and terminal management a Terminal Management System with an open architecture is proposed. The benefits will be fewer errors in management systems (reduced manual data input), optimal utilisation of terminal space and resources, possibility for invoicing basic and additional services and a transparent chain door-to-door. GPS and Radio Transmitter Systems can be used to improve identification and location inside intermodal terminals. Improved positioning of Gantry cranes can be achieved by laser positioning systems.

IMPULSE also showed that fast and smooth transshipment from moving trains is possible. This was achieved by the Krupp Fast Handling System Terminal Concept. The system consisted of light barrier curtains and camera systems for identification and location of the ITUs gripping points, cranes, cross conveyors and storage/buffer areas as well as a control and monitoring system.

Recommendations from IMPULSE is the usage of a new intermodal wagon allowing more, larger and heavier ITUs to be transported, even on networks with gauge limitations. Bogies and brakes must be designed to allow higher speeds and lower noise. For medium- and short-distance transport a shuttle train can be economically feasible, even less expensive than road transportation.

3.3.7 SIMTAG, Safe InterModal Transport across the Globe

SIMTAG's objective is to improve the safety and security of intermodal freight transports, in particularly in the area of dangerous goods and those that may be vulnerable to interference from terrorism (SIMTAG, website).

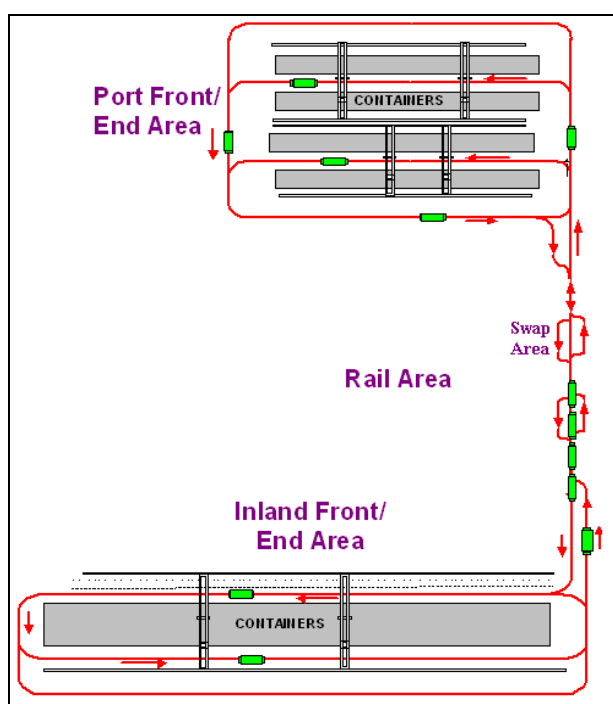
SIMTAG will address the end-to-end supply chain for both single-mode and multi-modal transport, including the security of at-source packing and loading procedures. It will endeavour to enhance the practicalities, safety and security of seamless transportation irrespective of mode, with a special emphasis on eliminating delay in the supply chain and the provision of enabling procedures to encourage modal shift from road to rail, sea and inland waterway. By providing both information and tracking facilities, SIMTAG will help to reduce delays in ports and terminals and make a significant contribution to a reduction in bottlenecks.

During the project a “black box” for monitoring and tracking containers will be developed. This “black box” will give the possibility for almost “real time” monitoring of location and condition (e.g. temperature and/or door/sealing integrity. Users will have access to the system via a web portal for accessing “black box” data. It will also be possible to integrate applications via the implementation of “loose coupling” interfaces, based principally on Web Services and Enterprise Application Integration.

3.3.8 ASAPP, Automated Shuttle for Augmented Port Performance, ASAPP-ONE, Intelligent Shuttle Fleet connecting a Split Container Storage Area for Intermodal Operation Improvement

The projects ASAPP (ASAPP, website) and ASAPP-ONE (ASAPP-ONE, website) aim at a drastic reduction of loading and unloading times of ships in ports and efficient transport of containers between ports and inland terminals/transportation networks, by using automated guided vehicles/shuttles. The shuttle used for container transport is highly manoeuvrable, computer controlled and electrically powered. It can run both autonomously and virtually coupled to others as a “train” in convoy mode, as well as be capable to run both on a concrete dedicated line and on rails.

The new terminal, the SPLIT terminal, consists of an inland depot, a sea port and a connecting rail. The inland depot (dry port) can be located in a suitable peripheral site, where it is connected to rail, road and/or inland waterway networks. The port only has to occupy a limited area for buffering containers. The two sites are connected via a dedicated single rail track.



ASAPP One system scenario

The usage of the shuttle can eliminate upwards of 2,000 lorries a day when used for transporting containers to the port from the inland terminal leading to less pollution and congestion around the port.

Modifications needed at the port will be limited, leading to a low investment cost. Calculations made show that this system has possibilities to lower the break-even distance for multimodal transports to around 200 km (Fifth F.P. webpage).

3.3.9 INHOTRA, Interoperable Intermodal Horizontal Transshipment

The INHOTRA (INHOTRA, website) project focused on the issues surrounding the integration of horizontal transshipment techniques in intermodal transports and

examined different technical approaches to be used in areas with lower or more intermittent cargo flows.

Three technologies has been developed and demonstrated in Hungary, Austria and Switzerland. They have possibilities to transfer cargo between rail and road transport but also have an option to be used in other scenarios as inland waterways. No new cargo modules were developed, instead ISO containers and swap bodies were used. Two other technologies, from Italy and Sweden, never were developed.

Of the three techniques the Austrian technique, the innovative transshipment terminal (IUT), has been implemented in the terminal Vienna Northwest of Rail Cargo Austria.



Implementation of the IUT (der Innovative Umschlags-Terminal)

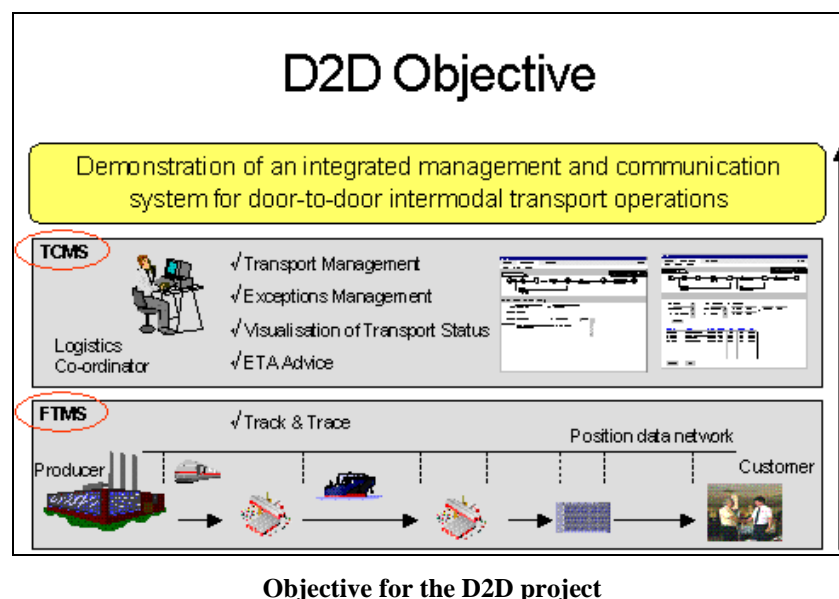
3.3.10 INFOLOG, Intermodal Information Link for Improved Logistics and D2D, Demonstration of an Integrated Management and Communication System for Door-to-Door Intermodal Freight Transport Operations

The goal of INFOLOG was to demonstrate improved efficiency of intermodal transports based on waterborne, road and rail transports by usage of better information and communication possibilities (INFOLOG, website) between shippers, forwarders, shipping agents, carriers, terminals and ports.

During the project a prototype of a Transport Chain Management System (TCMS) application was developed. The application used EDIFACT for message exchange but one of the two demonstrators also implemented the usage of XML-based messaging. The TCMS is modular so it can be extended to more complex logistics solutions. As data model the “TRIM” (Transport Reference Information Model) was used (TRIM, webpage). TRIM is based on the data needs from several European Union projects in the freight transport sector and was developed during the “INTERPORT” (INTERPORT, website) project.

TCMS is further used in the D2D project (D2D, website), which uses TCMS in conjunction with the FTMS (Freight Transport Monitoring System) system. The TCMS

will be used for document management, and the FTMS is used to provide transport status to the user.



3.3.11 INTRARTIP, Intermodal Transport Real Time Information Platform

The aim of the INTRARTIP (INTRARTIP, website) project was to develop a common framework for Pre-Contract Intermodal Information Systems aimed to facilitate the exchange of pre-contract information in the intermodal transport sector for contributing to integrate together all transport modes.

The INTRARTIP platform is XML-based, specific DTDs (Document Type Definition) were developed and XSL (eXtensible Stylesheet Language) was used for transformation to HTML (HyperText Markup Language) documents.

During evaluation users mentioned that the accuracy of the system was a weak point and needed further development. Another weak point was the security, authentication of users, in the system. The conclusion of the project partners was that the system was functional, with the reserve of some modifications, reliable, usable but not sufficient because process and download times was too long. Process/download times can be shortened using appropriate computer equipment and internet connection.

No information was found regarding further exploitation of INTRARTIP.

3.3.12 SPIN-HSV, Shipping Quality and Safety of High Speed Vessels, Terminals and Ports operations in Nodal Points

SPIN-HSV (SPIN-HSV, website) addresses questions about economic feasibility, comfort, safety and environmental impacts from high-speed vessels in the maritime sector.

SPIN-HSV has created reports about different types of High Speed Craft (HSC) and High-Speed Vessels (HSV), highlighting the operational and environmental problems concerning the usage of such craft/vessels. Countries of registration and routes have been analysed as well as passenger and cargo transport.

A great effort has been made in the project to analyse current and future possibilities for goods transportation by HSC/HSV vessels. Risk analysis and route planning have been performed, as well as a proposal for a port interface reference model.

The Port Interface Reference Model (SPIN-HSV, 2004) describes how a system for efficient use of HSC/HSV vessels can be built. To “standardise” the ship-shore interface is important, regarding fast and efficient port operations as port entering and unloading/loading. The result is a six-layer reference model describing: “Communication“, “Data“, “Procedures“, “Guided navigation“, “Passenger, means and goods“ and “Port interface strategy“.

	Function	What is behind
Layer 6	Port Interfacing Strategy	Strategic level covering all functions for logistics network, approach of the port, development scenarios, and harbour policy (the top level given by the harbour community)
Layer 5	Passenger, means and goods	Transport flow level covering passenger, means and goods (this is the main function level, the mission is smooth and efficient transport)
Layer 4	Guided Navigation	Comprises all functions for automatic flow control of HSV transport
Layer 3	Procedures	Comprises all functions for supporting flow control of HSV transport
Layer 2	Data	Provides description language for data communication required for procedures
Layer 1	Communication	Covers all functions for communication between different subsystems on-board and ashore

The Port Interface Reference Model

The SPIN-HSV project states that most of the real HSV services do not pay off (SPIN-HSV, 2004), as traffic figures are decreasing from year to year, support from tax-free sales is no longer available on most routes, and very often the HSV service is restricted to the season only. Looking into the pure efficiency it turns out, that transport of freight and /or cars by HSV is rather expensive due to the high fuel consumption, 5 to 10 times higher than road traffic. HSV can not replace road traffic, but it will be used only to bridge the waterway between two countries.

3.3.13 REALISE, Regional Action for Logistical Integration of Shipping across Europe

REALISE (REALISE, website) is a thematic network involving maritime transport practitioners and transport experts. REALISE draws together the results of the many projects around the EU which have sought to assist the development of short sea shipping.

Studies are or will be performed, leading to the development of specific methodologies in the areas of statistics, environmental impact analyses, and comparative multi-modal costing and pricing reports. A series of workshops will be performed to exchange and transfer the knowledge and experience developed from network activities. Finally REALISE will set up a modern short sea shipping portal, the Electronic Knowledge

Dissemination System (EKDS), enabling the exchange of knowledge and experience to be transmitted rapidly to a wider audience of relevant logistics business actors and policy-makers.

3.3.14 IQ, Intermodal Quality

The IQ (IQ, website) project aimed to analyse the quality aspects influencing intermodal transport, focusing on improvements in interoperability, interconnectivity and accessibility of terminals. The project intended to deal with both the quality of terminals and the quality of networks for different countries and segments at European and national levels.

Results from the IQ project show that even if there is a price competition between road and intermodal transport, the key difference lies in the quality of service, and that quality of intermodal services depends heavily on the type of train operating system (Cardebring et al., 2002). If shuttle and block trains are to be used for their high performance, a network solution is needed that uses key terminals as gateway points to the network and as hubs for flow integration. The project states that reducing the number of terminals offered can actually improve intermodal quality. Improving terminal location is more important than increasing the number of terminals.

The project results include performance and quality of terminals, rail transport and quality of networks and transport chain integration. Methods and tools usable for simulation and integration have also been developed during the project lifetime.

3.3.15 LOGIQ, Intermodal Decision (the decision making-process in intermodal transport)

The main objective of the LOGIQ (LOGIQ 1, website) project has been to identify actors in the decision-making process and to provide information on underlying criteria and constraints in the use of intermodal transport.

The three categories of variables identified as fundamental in affecting decision taken by actors were

- the infrastructure networks,
- the cost and quality factors influencing the transport chains and actors behaviours,
- the institutional environment of transport and relevant legal issues.

LOGIQ research proved that, considering the three actor types (forwarders/road transport companies, shippers, shipping lines), among the criteria examined:

- cost is the most important criterion in the decision-making process,
- reliability is the most important quality criterion,
- frequency of services offered and rail operating systems used are the most important criteria considered from the supply side, essentially for meeting the actors' requirements for reliability.

A decision support tool for intermodal transport, DSS (Decision Support System), has been developed (LOGIQ 2, website). It has possibilities to assist during company decisions about investments in intermodal transport. It also can assist policy makers in deciding which of the measures they can introduce to promote intermodal transport.

3.3.16 IDIOMA, Innovative Distribution with Intermodal Freight Operation in Metropolitan Areas

The IDIOMA (IDIOMA 1, website) project's main objective was to demonstrate the possibilities to improve the distribution of goods within metropolitan areas and between

intermodal transport terminal/freight centres and metropolitan areas. In particular the IDIOMA project comprised concepts focussing on:

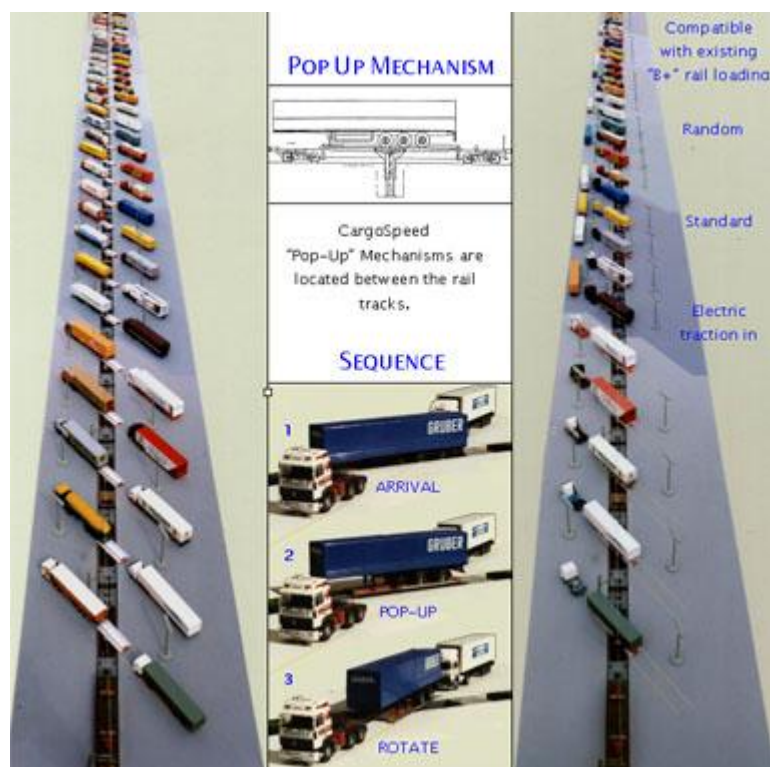
- regional or local bundling of urban freight transport, using common carriers or cooperative distribution concepts,
- new loading units in urban (intermodal) transport,
- improving operational and commercial information exchange in intermodal transport by means of innovative ICT-applications,
- innovative transshipment systems in intermodal transport,
- use of alternative fuels and energy sources in urban freight vehicles,
- combined passenger and freight transport concepts.

IDIOMA results (IDIOMA 2, website) include:

- Regional or local bundling projects in urban freight transport were only partially successful. Reduction of emissions can be achieved in intermodal transport chains but were difficult to implement in the current transport business environment.
- City/small container concepts can significantly reduce environmental impacts of freight transport. However the concepts demonstrated in IDIOMA met with technical problems. Even if the problems are solved, the economic perspective is still uncertain, as large investments may be needed.
- The integration of traffic information has a striking impact on the efficiency and competitiveness of the goods distribution system in urban areas.
- The horizontal transshipment system demonstrated was not commercially viable. A new generation of this kind of equipment is instead demonstrated in the INHOTRA project (INHOTRA, website).
- The ACTS system (Abroll-Container-System) proved already its capability for short distance rail transport, mainly for bulk goods, but has also possibilities for non-bulk transport chains in urban and regional distribution.
- The usage of alternative fuels significantly reduces emission levels.
- The advantages of integrated transport of passengers and freight to urban areas are fast access to city centres but cargo is limited in size and the transshipment is not ideal when this has to take place on passenger platforms.

3.3.17 CARGOSPEED, Cargo Rail/Road Interchange at Speed

The CargoSpeed (CARGOSPEED 1, website) project developed an innovative solution for using a rail freight system to operate within a truly balanced and sustainable intermodal transport system. The CargoSpeed system includes a wagon and a Pop-Up system placed at a dedicated terminal.



The CargoSpeed System

According to project partners the system will reduce the costs for road/rail intermodality, increase the speed of the operation at combined terminals and halve the economic break-even distance for intermodal freight movements (CARGOSPEED 2, website).

3.3.18 TACTICS, the Automated Conveying and Transfer of Intermodal Cargo Shipments

The TACTICS (TACTICS, website) project has demonstrated the viability and benefits of an automated intermodal transfer system. To achieve reliable automation the system has to be based on uniform defined loading units, called Small Loading Unit (SLU). The loading systems and SLUs used in the TACTICS system are based on the majority of standard ISO pallet formats. The system can also be used to handle bulk loads.

Three automated loading units (ALU) were designed and tested. They can all be used to complement the more common transfers as:

- loading bay to semi-trailer
- loading bay to container
- loading bay to rail wagon
- vehicle to vehicle (vehicle = semi-trailer, rail wagon, container)
- cross docking

The TACTICS system uses embedded radio frequency (RF) electronic tags to identify the loading units (SLUs), the vehicle or container during the distribution cycle.

3.3.19 ROLLING SHELF, Palletised Rail Goods

The ROLLING SHELF (RS) project (ROLLING SHELF 1, website) was aimed at reducing road traffic growth by developing new equipment to create a modal shift from road to rail transport. The system is based on automated goods transfer between terminals and a new rail wagon that will allow fast (maximum 20 minutes) and easy

loading and unloading of palletised goods. To achieve this, two kinds of load units were developed, a small one for three Euro-pallets and a larger one in the size of a D-class swap body. For fast horizontal transshipment a rail wagon equipped with roller beds and automatic doors was developed. Four types of terminals were developed, allowing between 100 (manual or partly automated) and over 2,000 (fully automated) pallets to be handled per day.

Main conclusions of the project were, according to the final report (ROLLING SHELF 2, website):

- Rolling Shelf fits within autonomous current business trends, such as the trend towards smaller consignment sizes.
- The technical concept is an innovative and smart solution for tackling the basic problems of current rail transport services.
- Business studies have shown that the RS can be profitable on specific relations (when system capacity is utilised).
- Success factors of the RS system are the fast transit and transshipment.

3.3.20 TERMINET, Towards a New Generation of Networks and Terminals for Multimodal Freight Transport

The central objective for TERMINET (TERMINET 1, website) was to identify promising innovative directions for bundling networks, new generation terminals and terminal nodes for combined uni-modal and intermodal transport in Europe. The TERMINET research resulted in new network and terminal designs, cost and performance analyses, simulation and animation tools and an identification of implementation barriers.

The new terminals were found to be economically feasible, compared to existing terminals, at high freight volumes (>200,000 units) as the existing terminals are subsidised and depreciated (only operating cost has to be covered).

To encourage investments and innovations TERMINET suggests (TERMINET 2, website) that government and organisations must play an active role in the work to bring different players together and create a “chain approach” for multimodal transports, which implies close co-operation between all actors and if necessary balancing of costs and benefits between them.

3.3.21 X-MODALL, the Optimisation of Modular Intermodal Freight Systems for Europe 2000+

The X-MODALL concept for intermodal transport was described in the X-MODALL/X-MOD/1 project (X-MODALL 1, website). The concept is designed to create a fully integrated European freight transport system which is based on an information system handling available transport capacity, demand for transport, use of the infrastructure and the assets.

The key elements (X-MODALL 2, website) in the system is a new network of nodes/terminals (X-NodeNet), rail transport elements (X-Rail), road transport elements (X-Road), freight units (X-Pak) and an information management system (X-CRS). The X-CRS will be a brokerage system, not only monitoring all assets but also planning their optimal use as well as the use of the infrastructure. It will be accessible for all actors in the system.

The project results show that the system has a potential to reduce the total costs of transport in Europe by 20% and to provide a high quality of freight transport.

3.3.22 INTERMODESHIP, the Intermodal Ship

The INTERMODESHIP (INTERMODESHIP 1, website) project aims to reduce significantly the problem of congestion on major European traffic arteries and its negative Impact on the environment through shifting of cargo volume from road to waterborne transport.

Objectives of the project are to create waterborne transport concepts for inland/short-sea operations for various types of cargo units, including swap bodies, faster cargo handling and better use of cargo space.

The solution will be the INTERMODESHIP optimized for inland/short-sea operations creating (INTERMODESHIP 2, website):

- a door-to-door waterborne solution
- positive effects on quality of life
- reduced pollution and noise
- reduced number of accidents
- improved utilization of infrastructure
- improved mobility of goods

3.3.23 GIFTS, Global Intermodal Freight Transport System

The GIFTS project (GIFTS, website) will develop an integrated operational platform for managing door-to-door freight transport in Europe. It will contain modules for e-document transfer, e-payment, tracking and tracing, support for trip/fleet management etc. Communication will be maintained using terrestrial and satellite systems and the Internet.

Three validation campaigns will be carried out in a real-life transport environment for road, rail and e-commerce applications.

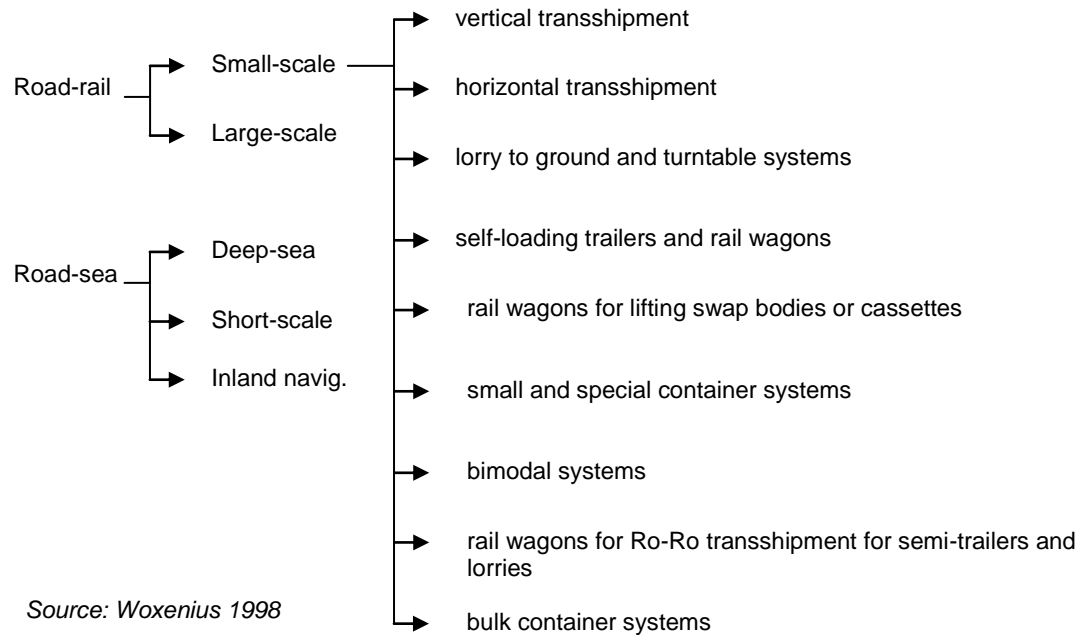
3.3.24 EUTP II, Thematic Network on Freight Transfer Points and Terminals

The main purpose of the EUTP II (EUTP II, website) project was to maintain the dynamic agreement activity created by the EUTP project with a view to further develop a framework and to enhance and create synergy in the European research effort, related to intermodal freight transfer points. It was a way to coordinate different projects on European as well as national levels, extend research information to the industry but also to be a meeting place for researchers and the industry.

During the project a website, <http://www.eutp.org/>, was created where active research projects was presented. The website is still up but it seems to lack maintenance.

3.4. Technologies in intermodality

One of the greatest challenges in intermodality is to solve the handling problem in terminals. The handling problem itself, type and possible solution, can be categorized by the involved modes of transports as in the following scheme:



In the scheme there are categorized different technological types of solutions for solving the handling problem in intermodal transports. Categories are from the two involved modes of transports, the size of the flow for which the combination of modes is used, and to the different types of handling solutions. (Woxenius 1998)

3.4.1 Small-scale road-rail solutions

Vertical transshipment: Cranes and counter-balanced trucks are typical representatives for this type of handling in intermodality. They basically grapple the load unit from above and the whole weight of the load must be borne by the equipment. The development of new types of vertical transshipment equipment is mainly driven by the producers of intermodal transports, which implies that the equipment is designed to be a part of the transport chain, rather than being a part of the intermodal flow.

Horizontal transshipment: As different to the vertical transshipment there is a need only for a very small vertical lift in horizontal transshipment. The container is lifted only as much as is needed, so that the legs can be folded and shift the carrying platform for the container. The large advantage is that this can take place under existing overhead contract lines and that the equipment does not need to sustain the whole weight of the load.

Lorry to ground and turntable systems: The main load unit is the ISO-container and to give it the needed flexibility the lorries must be able to load and unload containers autonomously without any help from other equipment. One common type of lorry to ground solution is the hook-lift systems. These have not been as successful as many believed; the main reason for this is in the problem of securing the goods inside the container. The turntable system is mainly a way for the container to be pulled from/to a rail wagon of the truck.

Self-loading trailers and rail wagons: The problem type is roughly the same as in *lorry to ground*, but instead of using different types of pulling techniques, the self-loading trailer and rail wagon can be described as a crane on each trailer. The container gets lifted in a vertical movement from/to the ground by the permanent crane mounted on the trailer or rail wagon.

Rail wagons for lifting swap bodies or cassettes: This idea is mainly the lorry to ground combined with *horizontal transshipment* techniques. It is developed by manufacturers of rail wagons. One advantage is that it does not interfere with other types of vertical transshipment equipment that could be used elsewhere in transportation chain.

Small and special container systems: One general trend in logistics is the increase of shipments and the reduction of volume per shipment from door-to-door. To meet this problem several types of smaller sized containers are being developed. The size is roughly based on the Euro-pallet, but a little larger. The advantage is that they are loaded by the consignor, handled by the forwarder and opened first by the consignee, even when the actual volume of goods is really small. This type of system solution can become an important contribution to future intermodal city distribution.

Bimodal systems: This solution type can easiest be explained as a road trailer, equipped also with railway wheels. In some cases the rail wheels are mounted on the trailer in the train terminal. The investments in the terminal for this type of solution is very small, only a railway at ground level is needed and means to drive the trailer up on it.

Railway wagons for ro-ro transshipment for semi-trailers and lorries: The development of roll on-roll off principles in ro-ro shipping has inspired designers to bring this concept to the road-rail intermodality. The lorry itself is driven up on the rail wagon at loading and the opposite when unloading. The invention is simple and the terminals only need a ramp to let the lorries drive onto the rail wagon. The concept of Rolling Highways is a part in this solution type.

Bulk and tank container systems: Goods that need less transport packaging like waste, liquids, powder and other bulk material, need a special type of containers for intermodal usage. They are in road transport carried by tank vehicles and similar, so for intermodal use the container can be a tank container, a tank inside a container shell, or a bulk container, a closed or sheeted unit for the transport of (usually solid) bulk cargo.

3.4.2 Large-scale road-rail solutions

Large-scale solutions for the road-rail interface require large investments in terminals and technology, but may be profitable in selected corridors. These solutions have the potential to be a highly automated gateway for all types of transports. The vision is a single terminal, very large, which by using conveyors to move containers fast and securely and integrated information system to guide them correctly to the right place at the right time has the ability to load and unload all types of transports.

3.4.3 Road-rail-sea solutions

To connect sea transport with the hinterland of a port has always been a problem regarding the port-hinterland leg. To solve this problem many industrial facilities have been placed relatively close to a port, as this problem and the mentioned solution were more common in the beginning of industrialisation than now. The development of rail and then road traffic changed this to make the distance to port less important. The main problem left to solve was the interface, how do we connect the hinterland with the ship's cargo capacity.

The most important invention in this area is the ISO-container. It may not be the optimum solution for all modes of transport involved but versatile enough for most of them. It was developed out of the long-distance sea transport and is therefore best adapted to ships. All major ports are today planned to receive larger volumes of containers each year. Over 90% of all world cargo is moved in containers. One problem

with ISO-containers is the different allowed maximum external dimensions that apply in different countries for road transport.

As ships and ports grew larger, a new problem became visible, the time to load or unload a container. The general solution here is large cranes and a different design of ships, out of which the container ships appeared. This led to more containers and more traffic between the port and its hinterland, which increased road traffic to, in some areas, volumes that are not sustainable.

To reduce road traffic to and from the port, tests have been carried out to transfer port-hinterland transport to inland waterways (where possible) and feeder traffic from smaller ports to larger ones.

3.4.4 Road-rail-air technologies

The introduction of air-freight at a large scale is fairly new in logistics. It follows a similar development as sea transport. The main (longest) transportation leg is accomplished by air and the rest is mostly done by road. The use of a standardized single load unit, a type of container, is the backbone of them both. The difference is that the air-freight container first of all must have as low weight as possible, where the sea container instead must be as robust as possible. These light-weight containers could be used in road or rail transports as well.

The air-freight container is smaller, because of the airplane's internal dimension and that it is more expensive to transport by air. The loading and unloading of airplanes are accomplished by equipping the inside floor with rollers, and the handling personal just rolls the container onboard.

4. Present state of intermodal transport in the EU

One of the keystones of the EU is the free movement of goods and people inside the union. Therefore it's obvious why the interest for logistics is big, because movement of neither goods nor people will take place without logistics. In time has the demand for logistics service constantly increased and there is no indication of any change in that. The movement has caused congestion in the road systems in some parts of the union. The magnitude of congestion depends on point of time in a day, week or year but when at peak load (rush hour) the high-ways demonstrate a stand-still or at best a viscous flow of vehicle, which is detrimental for economy and the environment. To relieve the pressure on the road system, foremost in central Europe, the EU and also national governments act to facilitate the use of non-road transports like rail and inland waterways.

The drawbacks in these modes of transports are similar to each other. They are slower than road transport in shorter distance (inland waterways is always slower) and are inflexible in comparison to road transports. To conduct a door-to-door transport with rail you will need to pick it up at the first door, take it to a terminal and load it on the train, drive the train to another terminal, unload it from the train and delivery it to the second door. The same road transport is instead, pick it up at the first door and delivery it to the second door. The main different is the two terminal activities which both takes time and money to perform. All this extra time and cost in comparison with road transport leads to that rail transport today are competitive in distances over 400-500 km. The problem is the most goods inside the EU are transported short distances with the congestion on highways as one result. This breakpoint must be reduced and the project FLIHHT aims to lower it to 200 km instead.

The railway system in Europe was developed and produced mainly before the EU was created. Therefore it still has a clear and obvious national distinctive character, this means that there are different types of standards that regulate things like engine type (frequency, voltage, diesel etc.), allowed load weight and dimension (width of tracks, tunnel dimensions etc). The EU has taken actions to eliminate these types of problems but they still make up an obstacle for intermodal transports.

In the definition of intermodal transports it says "*intermodal transport refers to the transport of goods in one and the same loading unit using successively several modes of transport*". The key phrase here is *in one and the same loading unit*, in reality it means that instead of handling the goods piecewise you handle a load unit that holds a certain amount of goods. This lowers the handling time, protects the goods and in general simplifies the whole door-to-door transport. Today there exist several different types of standardized containers, wagons and trailers. In some cases they are compatible with each other but far from always. This is a problem for intermodality. The need for a new standardized container that is independent of a certain type of wagon, trailer or similar equipment is apparent.

4.1. Motorways of the Sea

The Motorways of the Sea is an initiative within the TEN-T programme, aiming at developing the sea legs and port procedures of intermodal transport. As planned for the next Marco polo programme, a motorway of the sea action will be an innovative action directly shifting freight from road to an intermodal maritime service "to timely implement a very large volume, high frequency intermodal waterborne transport

service, and including non-road hinterland freight transport for integrated door-to-door services”. In the final Consultation Paper (Motorways of the Sea, 2004), possible ‘quality criteria’ (actually proposed actions in the administrative and infrastructural fields to facilitate sea/land intermodality) for states as well as for port authorities and terminal operators were identified:

1. Allow simplified customs procedures (e.g. use of shipping manifest as summary declaration and ‘authorised regular shipping services’ under the customs rules).
2. Provide for co-operation between the inspection bodies so that different authorities do not board the ship separately over a few hours (but together at the same time) or that only a limited number of separate authorities (maximum two) board every ship.
3. Allow unloading before all administrative procedures have been finalised and not require, for reasons of administrative control, a ship to wait for more than 30 minutes after mooring for the unloading to start.
4. Allow customs and other administrative data to be forwarded electronically through one-stop administrative shops (arrangements enabling commercial operators and carriers, including ships, to send to a single entry point all the information required by public authorities concerning the arrival, stay in port and departure of ships, persons and cargo). Alternatively, until sufficient technical capacity has been reached, this single entry point can consist of a single authority to which all administrative documentation and procedures are handed over in paper form and which takes care of co-ordination between different authorities (so that commercial operators and carriers hand in all the documentation only once and not separately to each separate authority).
5. Allow Pilot Exemption Certificates or other corresponding arrangements.
6. Enable traffic all year round (24/24, 7/7, 365/365) (also in winter ice-conditions) to/from port area.
7. Allow regular shipping to operate under bilateral or multilateral agreements on alternative security arrangements.
8. Allow the development of a mandatory systematic use of modern localisation and telecommunication techniques for all the operators of the maritime sector. This use shall allow both a better observance of all the legislation of all sorts that rules the sector and an easier communication between ship and shore to solve a vast array of issues related to the handling of the ship, its cargo or its passengers and its crew.
9. Provide the prerequisites for short-sea operators to use low-sulphur marine fuel.
10. Provide adequate port-hinterland connections:
 - Including rail and/or inland waterways in addition to road;
 - Providing sufficient capacity (e.g. easy road access, more than a single rail line) and technical capabilities;
 - The rail networks to and from ports should have open access for railway operators as stipulated in the Trans-European Rail Freight Network Directive (2001/12).
 - Ensuring free competition in hinterland haulage.
11. Have adequate procedures to handle Short Sea Shipping, including:
 - Allowing self-handling by seafaring personnel or by local personnel of the maritime operator, respecting all local conditions;
 - Enabling one-stop administrative shopping;
 - Providing electronic transmission of administrative data;
 - Treating ships equally without any particular priority given to deep-sea, short-sea or inland waterway vessels. This can be demonstrated by a transparent waiting system, separate (or designated) handling facilities or ‘first come, first served’;
 - Designing an Action Plan on how to take the specificities of Short Sea Shipping into consideration in day-to-day operations, fee structures and port management/planning.

12. Provide compatibility of port information systems and one-stop administrative shops between ports over Motorways of the Sea links (at least for the exchange of administrative data).
13. Have suitable port facilities to accommodate short-sea services. These could include ro-ro ramps, dedicated short-sea terminals or quays, short-sea specific handling equipment and/or marshalling yards next to short-sea services.
14. Be served sufficiently with VTMS, and, where, appropriate RIS.
15. Security: fulfil the requirements of the ISPS code and relevant Community legal instruments on ship/port facility/port security.
16. Allow tracking and tracing of goods in the port area.
17. Port reception facilities according to EC legislation.

4.2. Harmonisation of containers and other cargo units

The ISO container as standardised is globally accepted as the preferred cargo carrier unit. However there is a proliferation of different containers with different dimensions which are tailored to the specific needs of companies. Companies are investing in equipment which is specific to their logistical need because this increases their efficiency. And this equipment is very often designed for carriage by one specific transport mode. The transshipment of such units or containers is complicated and costly.

The task force noted that the European Union could act for more harmonised standards. Obviously European harmonised standards for containers would not make sense in a globalised economy. Nevertheless, in 2003, the Commission proposed a Framework Directive on standardisation and harmonisation of intermodal loading units. The goal of this measure is stated to reduce inefficiencies in intermodal transport, resulting from various sizes of containers circulating in Europe. Furthermore, the measure would help to better integrate short sea shipping into the intermodal transport chain. The more detailed objectives are:

- to make ILU compatible with all modes;
- to ensure the best handling maintenance of all Intermodal Loading Units;
- to simplify the transshipments in terminals for all the new Intermodal Loading Units;
- to propose a new unit, the European Intermodal Loading Unit which will be standardised. It has to be pallet wide, stackable, compatible with SSS, IWW, rail and road, to allow the top lifting and to fit the prescriptions of Directive 96/53.

The Commission proposes that:

- the use of existing ILU will be allowed, but they will have to comply the obligations established for containers by CSC, or similar;
- the use of ISO containers with a length compatible with Directive 96/53 will be allowed;
- new ILU will comply harmonisation rules regarding in particular handling and fixation;
- a new unit, the European ILU, will be standardised. It has to be pallet-wide, stackable, compatible with SSS, IWW, rail and road.

In its first reading on 12 February 2004, the European Parliament adopted the proposal and introduced amendments aimed at clarification and making sure that there are no incompatibilities between the Commission proposal and the global ISO rules. Subsequently, the Commission presented an amended proposal on 30 April 2004.

4.3. Freight Transport Management Systems

The European Commission (DG TREN) explains the needs for developing Freight Transport Management Systems by the following rationale (EU Policy on Intermodality and Logistics, 2004)

1. Need to improve the quality of alternative modes
 - efficiency
 - reliability
 - responsiveness
2. Alternatives to road transport require more
 - organisation
 - planning
 - monitoring
 - communication.
3. More effort to have common approach (EU25)

and the challenges:

1. Managing information flow - even more difficult in international and intermodal chains.
 - Different standards
 - Different investments
 - Different languages
 - Different modal cultures / traditions
2. Integration – a major challenge
 - of transport with other logistic tasks (often private data)
 - between modes (often « competitors »)
 - with modal traffic management (often public data)
3. Focus on the process of moving goods through supply chains not just the mode / vehicle (i.e. greater customer focus)
4. Not losing sight of the objectives – increasing quality and efficiency
5. Shared access (private / public)
 - Different interests
 - Responsibilities
 - Business models – who pays?
6. Increasing importance of security/energy/emissions aspects

4.4. Economic impact of carrier liability

The Communication on Intermodality and International Freight Transport (COM(97) 243) established that a lack of uniform carrier liability arrangement, which tends to lead to additional (i.e. friction) costs surrounding the associated insurance system, is an impediment for further development of freight intermodalism in the European Union. Subsequently, by an EU contract, the underlying economics of carrier liability in the context of intermodal freight transport were studied, and some recommendations were extracted (IM Technologies, 2001):

- The EC should invest time and effort on seeking and facilitating greater harmonisation of conditions of carrier liability in order to secure the potential reduction in friction costs for intermodal transport;
- It would be sensible for the EC to seek incremental improvements focussing first on harmonising the conditions for the road, railway and inland water modes, which form the core modes for intra-EU freight;
- It would be more pragmatic to aim for a regional solution covering the EU, the accession countries and the neighbouring countries as this should prove easier as

the CMR and CIM/COTIF conventions have similar spatial coverage and the CMNI conventions is very much a pan-European affair;

- The EC and many other international institutions, e.g. UN/ECE, OECD, CMI and UNCITRAL, are currently pursuing further development in carrier liability for multimodal transport and it will be sensible for the EC to work with the various institutions;
- The EC should engage the EU Member States to include national level operations - warehousing, terminal, infrastructure – as part of the process to create harmonisation across the transport supply chain from end to end; and
- Above all the EC should facilitate the use of common language for EU15 at local level and support further work on internet and e-commerce business-to-business platforms which bring benefits to both intermodal and unimodal transport.

4.5. Security and safety

After September 11th, the U.S. government initiated high priority measures to raise the security in ports and terminals. Successively the IMO has followed suite, by publishing the ISPS (International Ship and Port Facility Security) Code (ISPS, 2004), as well as the European Commission by issuing a Regulation on enhancing Ship and Port Facility Security (Port Security Regulation, 2004) and a proposed Directive on the same topic (Port Security Directive, 2004). The shipping industry was forced by these measures to make substantial investments in infrastructure and routines, which, while actually enhancing security, are believed to increase the complexity of the ship-port-hinterland transport chain, having adverse effects on intermodality.

The Container Security Initiative (CSI) is a U.S. programme to increase security for containerized cargo shipped to the United States from around the world (CSI, 2002). CSI consists of four core elements:

- Using intelligence and automated information to identify and target containers that pose a risk for terrorism,
- pre-screening those containers that pose a risk at the port of departure, before they arrive at U.S. ports,
- using detection technology to quickly pre-screen containers that pose a risk,
- using smarter, tamper-evident containers.

Generally the CSI is also believed to be adverse to intermodal efficiency, but it is likely to have negligible impact on the use of containers as cargo units. Another initiative from the same source is C-TPAT (Customs-Trade Partnership Against Terrorism), described as a joint government-business initiative to build cooperative relationships that strengthen overall supply chain and border security. It affects all parts of the supply and transport chain in trade relationships with the U.S.A.

The risk of conventional crime, such as cargo theft, and physical damage to cargo is believed to increase in transport chains with several nodes, i.e. ports and terminals where the cargo is handled and reloaded.

5. Conclusions

In its Diagnosis Report of 1996 the European Task Force Transport Intermodality identified the obstacles that prevent the development of user-oriented door-to-door intermodal transport services. The findings of this report still apply, including the six priority themes which were found to be of major interest for the improvement of intermodal transport in the European Union and suggested for focusing future research and development activities:

- Transfer point efficiency;
- Intermodal network efficiency;
- Information and communication technologies;
- Improvement of transport means and transport equipment;
- Market conditions;
- Training and market-oriented strategies.

The work of the task force up to 1997 is also documented at the Cordis website (Task Force, website).

5.1. Obstacles to freight intermodality

There are several obstacles to intermodal transport, which make it unattractive (more complicated, more expensive, time-consuming) compared to an equivalent journey by road. Some are of a regulatory nature and will have to be dealt with by the public authorities, including the European Community. Examples are the administrative procedures, which need harmonization between modes and countries, competition rules which will assist the European single market, and infrastructure issues, such as that the railway systems are still being developed and used from a rather strict national viewpoint.

Transshipment of cargo may be inefficient and costly, arrival and departure times may need to be coordinated, operators do in several cases not accept the responsibility for complete door-to-door delivery. These are obstacles that can be eliminated or reduced by the operators themselves, but with support from research and development. The initiative to develop a standardized single load unit that is adequate for all types of transports may help to simplify and speed up also handling of goods in terminals, e.g. by facilitating automated handling and transshipment.

One explanation of the lack of success of intermodal transport may be that its advantages of, such as less energy use, less pollution, fewer traffic accidents and less congestion, are of a societal nature, while the disadvantages, such as higher cost, more cargo damage, longer delivery times, complex coordination

5.2. The role of information technology

It has often been emphasized that there is a need for an integrated information system, which increases the possibility to coordinate and control the flow of cargo, containers and vehicles. As mentioned above (section 4.3) there is a clear rationale for the deployment of efficient information and communications systems to support intermodality. It should of course also be noted that information systems alone do not mitigate the obstacles to intermodality. Infrastructures, transshipment technology, pricing and economic realities and incitements, market considerations, customer awareness etc. are of course also essential elements. However, ICT systems after all have a crucial role in intermodal transport because of the greater need for coordination.

Information support is important to organize and manage intermodal transport services from door-to-door. It will provide the desired transparency of available services for the shipper, who often is not aware of the opportunities of intermodal solutions.

5.3. Measures of performance

For any door-to-door transport chain, the performance of intermodal transport will always be compared with road transport in terms of cost, reliability and quality of service. The main challenge here is for intermodality to demonstrate superior added value to the supply or demand chains. The task force identified a number of criteria for benchmarking the performance of intermodal transport, as follows:

- prices (cost per kilometre, cost per tonne)
- time (speed) and timing (reliability)
- regularity of services (frequency)
- safety records (damages and losses)
- quality management (user-friendliness, documentation accuracy)
- efficiency (e.g. personnel employed versus number of movements, empty kilometres run)

These are essential factors, for example as elements in a checklist for cost-benefit assessments.

5.4. Items to be addressed in the Intermode-TRANS project

The present survey points at a number of problems and questions that need further clarification. During the course of the Intermode-TRANS project a series of workshops will be arranged, to gather stakeholders and interested parties for a discussion of urgency of measures, best practices in relation to the current state of art and needs for future research in intermodality. A number of questions have materialized during the compilation of the present report, some of which are listed here as a suggestion for workshop items.

1. Do you use intermodal solutions for your distribution? (yes/no)

If yes, please rank the motivation factors

- time saving
- cost effectiveness
- reliability
- frequency of connections
- safety and security
- accessibility
- auxiliary services
- other _____

If no, please rank the factors against

- economically disadvantageous
- lack of infrastructure
- hassle in transshipment
- too infrequent connections
- lack of standards
- cargo damage
- customer preferences
- security concerns
- inflexibility

- lacking reliability
 - too short distances (typically _____ km)
 - other _____
2. What are in your opinion the most important measures to support intermodality and enhance its competitiveness against single-mode road transport? Please rank and comment.
- Improved transshipment equipment
 - Improved transshipment methods and routines, such as automated loading, transfer and unloading
 - New container and pallet standards
 - Development of logistic information systems, web services and software
 - More efficient rail connections
 - More efficient waterborne connections
 - More appropriate infrastructure in ports and terminals
 - Revision of economic mechanisms (taxes, rates, fees, ...)
 - Quality systems and concepts
 - Additional safety and security measures
 - Legislation – new rules and regulations
 - Legislation – simplified rules and regulations
 - Standardization
 - Awareness campaigns and information
3. Have you for any purpose examined and used results from European projects and initiatives on intermodality, such as the Motorways of the Sea, Marco Polo, SIMTAG, InterReg ...? (Yes/no, if yes which ones?)
4. Which areas are in need of further research, with respect to intermodal transport?
- Transshipment processes
 - Cargo carrier technology
 - Impact of economic conditions and incitements
 - Impact of legislation
 - Information technology systems

- Infrastructure, such as terminal locations, dry port concepts
 - Risk, safety and security
 - Cargo identification, tracking and tracing
5. Rank the following changes according to their importance regarding the ability of multimodal transport to compete with single-mode transport:
 - Increased competition in the business
 - Better coordination between the countries in the EU, regarding standardization of containers, width of track, signal and control systems etc.
 - Reducing bottlenecks in the infrastructure
 - Better reliability in on-time delivery
 - Better focus on customers' needs and goals
 6. What are the characteristics of the primary market for multimodal transport inside the EU?
 7. How can the business sector improve its own ability to fulfil the characteristics of the primary market for intermodal transport?
 8. How can the authorities improve the business environment of the primary market for intermodal transport?
 9. What are the characteristics of the secondary market for multimodal transport inside the EU?
 10. How can the business sector improve its own ability to fulfil the characteristics of the secondary market for intermodal transport?
 11. How can the authorities improve the business environment of the secondary market for intermodal transport?
 12. What is the greatest challenge for success of the gateway concept?
 13. What are the main problems when developing an appropriate gateway?
 14. What are the geographical requirements for a gateway?
 15. What are the technological obstacles, if any, for a gateway?
 16. How can the authorities improve the business environment to facilitate the development of gateways?
 17. How will the CSI (the Container Security Initiative) affect intermodality in the EU?
 18. Will the C-TPAT (Customs-Trade Partnership Against Terrorism) affect intermodality in the EU?

19. How will the ISPS (International Ship and Port Facility Security) Code, the European Regulation on Enhancing Ship and Port Facility Security and the proposed European Directive on Enhancing Port Security transform the port-hinterland interface?
20. Can the business anticipate the introduction of a parallel to the ISPS Code for inland terminals?
21. Is security in terminals a major concern?
22. As a short handling time of cargo units is essential for the success of intermodality, how much and by what methods can it be made shorter?
23. Rank the following abilities of a new standard container after their importance for intermodal transportation.
 - Stackable
 - Easy to load, reload and unload by automated procedures
 - Resistant to theft
 - Traceable in real-time
24. Is there a need for the EU to develop a new standard for containers and if so, what would be the rationale for it?
25. Which geographical areas of Europe would have particular benefits of intermodal transport corridors, and what actions should be taken to promote such development?

6. References

Amended proposal for a Directive of the European Parliament and of the Council on Intermodal Loading Units, COM (2004) 361 final, 2003/0056 (COD)

Cardebring, Peter W., R. Fiedler, Chr. Reynaud, P. Weaver (2002), Summary report of the IQ Project, Analysing Intermodal Quality; a key step toward enhancing intermodal performance and market share in Europe, BMT Transport Solutions, Hamburg 2003

CSI (2002), The Container Security Initiative (CSI), U.S. Customs and Border Protection (CBP), Washington D.C.

European Commission White Paper (2001): European Transport Policy for 2010: Time to decide, COM (2001) 370 - 12

Henstra D. and J. Woxenius (2000), Intermodal Transport in Europe, TNO report Inro/log 2000-26 (TRILOG-Europe)

IM Technologies (2001), The economic impact of carrier liability on intermodal freight transport, Final Report, EC, London 2001
(http://europa.eu.int/comm/transport/intermodality/highlights/doc/final_report.pdf)

Intermode-TRANS (2004), Annex I - Description of Work, Proposal/Contract no. 003760, SSA in EU 6th F.P.

ISPS (2004), The International Code for the Security of Ships and Port Facilities (ISPS Code), International Maritime Organization (IMO), London

Motorways of the Sea (2004), Implementation through Article 12a TEN-T, A Consultation Document by the Services of the DG TREN, Brussels

Port Security Directive (2004), Proposal for a Directive of the European Parliament and of the Council on enhancing port security, COM/2004/0076 final - COD 2004/0031

Port Security Regulation (2004), Regulation (EC) No 725/2004 of the European Parliament and of the Council of 31 March 2004 on enhancing ship and port facility security, OJ L129/ 6, 29.4.2004

SPIN-HSV (2004) Deliverable D5.8, Public Summary Report of work package n°5

Woxenius, J. (1998), Intermodal Transshipment Technologies – An Overview), Chalmers University of Technology, Gothenburg

Woxenius, J. (2003), Intermodala transporter och SJ/Green Cargos utvecklingsprojekt Lättkombi (Intermodal transport and SJ/Green Cargo's development project Light Combi, in Swedish), Chalmers University of Technology, Gothenburg

Webpages

ASAPP:

http://ica.cordis.lu/search/index.cfm?fuseaction=proj.simpledocument&PJ_RC�=3022829&CFID=1646184&CFTOKEN=91232572

ASAPP-ONE:

http://ica.cordis.lu/search/index.cfm?fuseaction=proj.simpledocument&PJ_RC�=5117953&CFID=1646184&CFTOKEN=91232572

CARGOSPEED 1:

<http://www.cargospeed.net>

CARGOSPEED 2:

http://dbs.cordis.lu/fep-cgi/srchidadb?CALLER=PROJ_GROWTH&ACTION=D&QM_EP_RCN_A=54544

Combined transport: intermodality of goods transport:

<http://europa.eu.int/scadplus/leg/en/lvb/l24179.htm>

D2D:

<http://www.d2d.no/D2D/index.jsp>

ECMT (1996), Declaration on combined transport, CEMT/CM(96)16:

<http://www1.oecd.org/cem/topics/combined/CM9616e.pdf>

EMOLITE 1:

ftp://ftp.cordis.lu/pub/transport/docs/summaries/strategic_emolite_report.pdf

EMOLITE 2:

<http://europa.eu.int/comm/transport/extra/web/downloadfunction.cfm?docname=200310/emolite.pdf&apptype=application/pdf>

EU Policy on Intermodality and Logistics, 2004:

http://europa.eu.int/comm/transport/intermodality/highlights/doc/eu_policy_on_intermodality_and_logistics.pdf

EUTP II:

<http://www.eutp.org/>

Fifth F.P. webpage, Integrated transport chains - Ship, train, and truck:

<http://europa.eu.int/comm/research/growth/gcc/projects/transport-chains.html>

FLIHTT 1:

http://dbs.cordis.lu/cordis-cgi/srchidadb?ACTION=D&SESSION=288262001-11-6&DOC=1&TBL=EN_PROJ&RCN=EP_RCN:32556&CALLER=EISIMPLE_EN_PROJ

FLIHTT 2:

<http://europa.eu.int/comm/research/growth/gcc/projects/transport-chains.html>

FLIHTT 3:

<http://europa.eu.int/comm/research/rtdinf21/en/transport.html#1>

GIFTS:

http://ica.cordis.lu/search/index.cfm?fuseaction=proj.simplesdocument&PJ_RCN=5411292&CFID=1666606&CFTOKEN=17364719

IDIOMA 1:

ftp://ftp.cordis.lu/pub/transport/docs/summaries/integrated_idioma_report.pdf

IDIOMA 2:

<http://europa.eu.int/comm/transport/extra/web/downloadfunction.cfm?docname=200310/idioma.pdf&apptype=application/pdf>

IMPULSE:

ftp://ftp.cordis.lu/pub/transport/docs/summaries/integrated_impulse_report.pdf

INFOLOG:

ftp://ftp.cordis.lu/pub/transport/docs/summaries/waterborne_infolog_report.pdf

INHOTRA:

<http://www.inhotra.org/>

INTEGRATION 1:

http://ica.cordis.lu/search/index.cfm?fuseaction=proj.simplesdocument&PJ_RCN=5691604&CFID=1640131&CFTOKEN=35765476

INTEGRATION 2:

<http://www.integration.cetena.it>

INTERMODESHIP 1:

http://ica.cordis.lu/search/index.cfm?fuseaction=proj.simpledocument&PJ_RCN=5905647&CFID=1659356&CFTOKEN=63847486

INTERMODESHIP 2:

<http://www.kockumseng.se/intermodeship/>

INTERPORT:

<http://www.bmt-ts.com/interport/download/final.pdf>

INTRARTIP:

<http://www.cordis.lu/transport/src/intrarti.htm>

IPSI 1:

<http://www.cordis.lu/transport/src/ipsi.htm>

IPSI 2:

<http://europa.eu.int/comm/transport/extra/web/downloadfunction.cfm?docname=200310/ipsi.pdf&apptype=application/pdf>

IQ:

<http://europa.eu.int/comm/transport/extra/web/downloadfunction.cfm?docname=200310/iq.pdf&apptype=application/pdf>

LOGIQ 1:

http://ica.cordis.lu/search/index.cfm?fuseaction=result.simpledocument&RS_RCN=4862914&CFID=1652662&CFTOKEN=66474167

LOGIQ 2:

<http://europa.eu.int/comm/transport/extra/web/downloadfunction.cfm?docname=200310/logiq.pdf&apptype=application/pdf>

MARCO POLO Programme:

http://europa.eu.int/comm/transport/marcopolo/index_en.htm

Motorways of the Sea:

http://europa.eu.int/comm/transport/intermodality/motorways_sea/index_en.htm

REALISE:

<http://www.realise-sss.org/>

ROLLING SHELF 1:

<http://www.cordis.lu/transport/src/rolling.htm>

ROLLING SHELF 2:

<http://europa.eu.int/comm/transport/extra/web/downloadfunction.cfm?docname=200310/rollingshelf.pdf&apptype=application/pdf>

SIMTAG:

<http://www.simtag.org/>

SPIN-HSV:

<http://www.spin.mettle.org/>

TACTICS:

<http://www.cordis.lu/transport/src/tactics.htm>

Task Force Intermodal Transport:

<http://www.cordis.lu/transport/src/taskforce/src/iftqna.htm>

TERMINET 1:

<http://www.cordis.lu/transport/src/terminet.htm>

TERMINET 2:

<http://europa.eu.int/comm/transport/extra/web/downloadfunction.cfm?docname=200310/terminet.pdf& apptype=application/pdf>

TRIM, Transport Reference Information Model:

<http://www.sintef.no/static/td/projects/trim/>

White Paper: European Transport Policy for 2010: time to decide:

http://europa.eu.int/comm/energy_transport/en/lb_en.html

X-MODALL 1:

<http://www.cordis.lu/transport/src/x-modall.htm>

X-MODALL 2:

ftp://ftp.cordis.lu/pub/transport/docs/summaries/integrated_x-modall_report.pdf