SmartRivers 2006

International Conference Report

"Inland Waterways and the Global Supply Chain"

Prepared for:

American Association of State Highway Transportation Officials

Institute for Trade and Transportation Studies

Rahall Transportation Institute

Port of Pittsburgh Commission

Prepared by:
RNO Group
www.rnogroup.com

March 2007

FOREWORD

This report is the result of the SmartRivers 2006, International Conference held on November 7, 2006 in Brussels, Belgium. The conference was a continuation of SmartRivers 21, a cooperative effort through a series of international conferences to share information, ideas and technologies between inland waterway transportation officials, industry leaders and operators in the United States and Europe. It is an international coalition intent on realizing "Strategic Maritime Asset Research and Transformation for 21st Century River Systems", started in 2004 by the signature of a cooperative agreement between US and European partners, specifically the European Federation of Inland Ports (EFIP), the Transport Infrastructure Needs Assessment (TINA) Vienna, the Austrian Waterways Administration Company (via Donau), the Permanent International Association of Navigation Congresses (PIANC) and the Port of Pittsburgh Commission.

The SmartRivers 2006 International Conference was organized by the EFIP in collaboration with the Port of Pittsburgh Commission, TINA Vienna and via Donau, with the kind support of the American Association of State and Highway Transportation Officials (AASHTO), the Institute for Trade and Transportation Studies (ITTS), and Marshall University and the planning support of PIANC, the Transportation Research Board (TRB), the National Waterways Conference (NWC), the Waterways Council, Inc. (WCI) and Inland Rivers, Ports and Terminals (IRPT).

Speakers and participants in the Conference included European institutions and US Administration representatives, major stakeholders in the inland waterways and ports sector, client representatives and trade associations. In addition to attending the conference, members of the United States delegation also conducted site visits at the Port of Brussels, Port of Antwerp, Port of Rotterdam, the Strépy Thieu Lift, and attended a presentation of the River Information Services by via Donau.

Table of Contents

OVERVIEW

There exists a need for cooperation between the United States and Europe and the sharing of ideas, information and technologies related to inland waterway transportation. The relative role of overall inland waterway transport in the United States, accounting for approximately 12% of the total tonnage volume of all goods transported stateside compared to 7% in Europe, provides a lesson in success worth sharing in Europe. On the other hand, the success of container-on-barge (COB) services in Europe, where COB enjoys a modal share of up to one third of containers shipped along its largest corridors, provides a lesson in success worth sharing in the United States.

The focus of this report is on the factors that drive Europe's successful COB markets, and the lessons that can be applied in the United States.

KEY FINDINGS & PREREQUISITES FOR SUCCESS

Cutting Landside Transportation Costs. Container gateway ports located upriver and closer to the hinterland markets in Europe are gaining market share from those located on the coast. This trend results from shippers and carriers trying to minimize landside transport costs by choosing ports located farther inland. This is similar to the growing use of all-ocean lanes between Asia and the United States east coast, avoiding congestion at west coast ports and growing land-bridge transport costs.

Eroding Modal Market Shares. While inland waterways are an absolutely vital part of the multi-modal system, specifically in the case of bulk/liquid commodities, they are losing market share versus the highway mode. Moreover, the inland waterway system is significantly underutilized, especially in the high-service international container and domestic intermodal markets.

Container-on-barge Services are Viable and Sustainable. Container-on-barge services in Europe have become an essential link in the transport of containers between hinterland markets and coastal gateway ports. Some markets have grown as much as ten-fold during the past decade. Container-on-barge services are also in existence in the United States, particularly in the northwest, the Gulf Coast and along the eastern seaboard.

International Gateway Port. The most successful container-on-barge examples have at least one major international container gateway seaport at the mouth of the waterway. The international gateway is the critical node between the domestic inland container barge services and the international container ship services to major offshore container trade markets.

Significant Concentrations of Upstream Economic Activity. Container-on-barge services are most sustainable if there are significant existing or potential volumes of international maritime containers moving between the requisite international gateway port and inland markets. The first tier-inland markets are typically adjacent to or within close proximity to a navigable waterway.

Reliable, Rapid & Scheduled Services. The conditions and characteristics of the waterway system have to

support a rapid and scheduled service that is reliable. These include depth, minimal locks, and manageable distances. The experience in Europe shows that frequency and level of service is the most important means for competing with trucking services.

Mode Shift Policies and Mechanisms. It is the policy of the European Union to affect a modal shift from trucks to rail and waterways. Successful European programs such as Marco Polo account for costs traditionally viewed as external, such as emissions and traffic congestion, internalizing them into market based subsidies designed to take traffic off the highways and on to the waterways.

Targeted Policies, Subsidies and Incentives. Policies, incentives and subsidies are an important tool toward supporting and growing a start-up COB service to a break-even level of operation. In order for the waterways to compete and provide optimum levels of service and reliability requisite to the container markets, it is important to focus on those market segments where there is significant level of scale. Scale is also critical in terms of attaining measurable and real benefits to congestion and the environment.

Market Segmentation. Passive supply side approaches and the reliance on trends such as converging transport costs are not achieving needed results. Market segmentation provides a tactical means for optimally directing policies, funding, incentives, promotion, marketing and project development efforts at segments of the waterway system that provide the most ideal conditions for operating COB services.

Linkage with Shippers, Carriers and Gateway Ports. Targeted relationships with shippers seeking lower-cost and reliable mode options, with ocean carriers seeking alternative land transport options and with gateway ports that proactively encourage modal diversity has worked well in Europe. Alliances with freight forwarders has proved less than successful, usually resulting in pricing wars undermining the success of fledgling barge services.

Innovations and Technology. The use, reliability and efficiency of the waterway system is enhanced through the development and application of new technologies and innovations.

Cost, Applicability and Speed of Vessels. Further research is needed into the development of faster and lower-cost vessels that are specifically designed and built to serve the marine container market.

INTEGRATING WATERWAYS INTO THE GLOBAL SUPPLY CHAIN

The global trade of goods, specifically containerized shipments, has increased significantly over the past few decades, growing at double digit rates. Consumers in Europe and North America demanding cheaper electronics, textiles, shoes and other products particularly from Asia is a key contributor driving this growth. This has resulted in a significant growth in transshipment volumes at international seaports.

Transshipment volumes have grown from 100 million twenty feet equivalent units (TEUs) of containers in the early 1990's to 350 million TEUs by 2005. The estimates for 2015 are between 600 and 700 million TEUs[1]. Bottlenecks at global gateway ports are threatening the growth of global trade. Overloaded and congested railway and highway networks serving the hinterland markets are one of the key factors contributing to bottlenecks at the gateway ports.

While waterways in Europe and Asia have been integrated into the global supply chain for containerized shipments, it is less the case in the United States. The focus of this report is to identify opportunities and challenges towards integrating the U.S. waterways into the global supply chain to reduce congestion and bottlenecks at the country's major global gateway ports.

The U.S. waterway system plays a very important part in supporting the national economy, transporting approximately 12% of the total tonnage volume of all goods shipped within the United States. Waterways play a particularly important role in shipping bulk commodities such as coal, grain, aggregates and sand as well as liquid bulk products such as chemicals and petroleum products. However, the COB market as it exists today in the United States cannot be viewed as playing a major and integral part in the shipment of containers between ports and hinterland markets.

The United States waterway system faces significant institutional challenges that stand in the way of its long-term viability. This report recognizes these challenges and supports efforts to continue resolving these challenges as listed below.

Institutional Challenges to Improving U.S Waterway System

Invisibility	Quiet, low profile, and off the public's radar
Reliability	Infrastructure (locks) is an aging system
Sustainability	Asset failures risk acceptable levels of service
Continuity	Financial continuity across fiscal years
Compatibility	Conflicting demands for water resources
Interoperability	Linking the inland system with gateway ports and other modes
Security	Unfunded mandates

Source: US Army Corps of Engineers, 2006.

Recognizing that these challenges need to be addressed in order for the waterway system to remain viable as a primary mode of transportation, this report focuses on the opportunities of developing large-scale and sustainable COB operations throughout the inland waterway system.

The central theme of this report is on the importance of integrating the waterway system into the

[1] Final Report: Container Liner Service DANUBE (COLD), August 2006; via Donau.

overall global supply chain. The global containerized shipping business operates in a rapidly changing neuro-logistics environment, requiring the modes that serve this sector to be cost-effective, rapid and reliable. The United States inland waterway system is currently suited for bulk transportation where densities and cost are a far greater imperative than reliability and speed.

OVERVIEW OF THE EUROPEAN WATERWAYS

> *The European Commission's director for maritime and river transport, Fotis Karamitsos, has called for Europe to increase its use of inland waterways to transport cargo. The US is far ahead of Europe, with 12% of the country's inland transport taking place on its waterways. European waterways, in contrast, carry only 6%. Says Karamitsos, "It is important to accelerate our work because transport systems in Europe are suffering from congestion, capacity problems and delays detrimental to environment and public health."*[2]

Europe has an Extensive Waterway System

Europe has an extensive system of canals and rivers that link together hundreds of key industrial towns and areas. A core network consists of 6,000 miles that connects The Netherlands, Belgium, Luxembourg, France, Germany, Austria, Slovakia and Hungary within the EU, with Switzerland, Poland, Croatia, Serbia and Montenegro, Romania, Bulgaria, Moldova and Ukraine outside of the Union. The backbone of this network is constituted by major rivers such as the Rhine, the Elbe, the Seine and the Danube. However, despite its extensive network, the European waterways are generally viewed as under utilized, as is the case in the United States.

Europe's Major Waterways

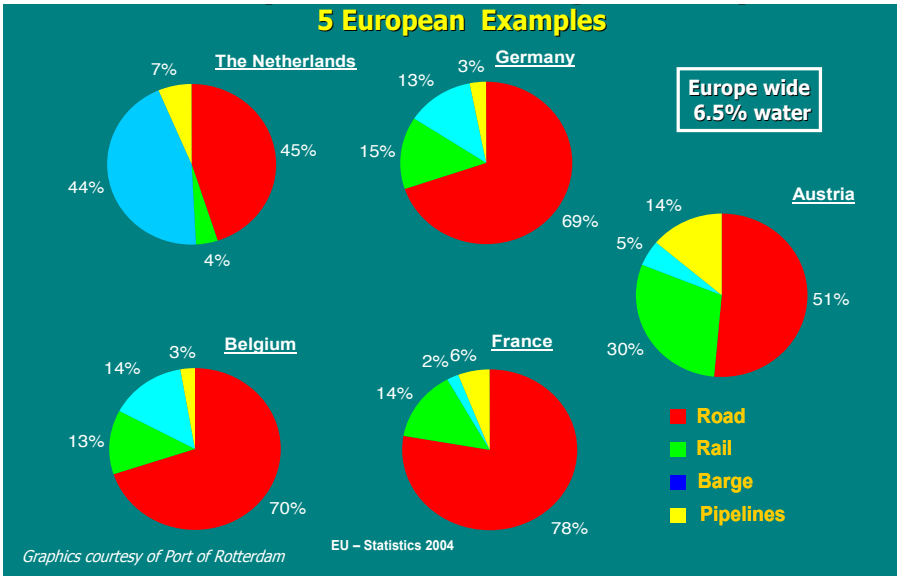
Courtesy of European Federation of Inland Ports

While the European system plays a significant role in transporting goods, the overall mode share

[2] Dry Cargo International Magazine, *European Waterway Usage Falls Way Behind*; 1/3/2007.

ranges between 6% and 7% of all goods shipped. Moreover, the level of success varies significantly by nation and market. In the Netherlands, waterways carry approximately 44% of all goods, compared to 2% in France. And although waterways are viewed as critical for addressing highway congestion, and a surrogate for rail transport, Europe's waterways have experienced a gradual erosion in market-share from a high of 12% in 1970's[3].

Modal Shares Across All Cargo Transport Modes



Heavy Emphasis on Strengthening the Role of Waterways

As a result of growing overseas trade and continued EU enlargement to include Central and Eastern Europe, the European Commission has put together a program aimed at promoting and strengthening the competitive position of inland waterway transport, in particular by enhancing its integration into multi-modal supply chains. In January of 2006, the European commission outlined a program called the Navigation and Inland Waterway Action and Development in Europe (NAIADES)[4] to strengthen the role of the waterway system in freight transportation. This new program to be implemented by member states through 2013 will focus on five fundamental aspects: Markets, Fleets, Jobs and Skills, Image, and Infrastructure.

[3] River Information Services brochure, European Commission, 2002.

[4] An Integrated European Action Programme for Inland Waterway Transport; Communication From The Commission On The Promotion Of Inland Waterway Transport "NAIADES"; Brussels, 17.1.2006.

Well Developed Institutional Framework

The institutional structure for overseeing, implementing and developing the waterway system is somewhat complex. Europe's institutional framework consists of several levels. At the top are European wide organizations that are focused on navigation, research and development, subsidies and incentives, and oversight towards equal competition and competitiveness between countries and across sectors. The next tiers of institutional entities are at the national levels which include Waterway Development Agencies that are responsible for the promotion and development of waterway traffic, as well as national government agencies responsible for dredging and the maintenance of locks. The next institutional tier focuses on specific corridors which can cross more than one country. Responsibilities and activities at this level usually include the development of international treaties, as well as the development of long-term strategic plans across all modes within the corridors. The final tier are the inland markets and cities within which inland ports are owned and operated.

Institutional Framework for Waterways

Container-on- Barge Operations are a Success in Europe

Container-on-barge services in Europe are well developed and robust, specifically when compared with the United States. Europe's rivers and canals carry more than 4 million TEUs of containers per year (2005), up from a level of 500,000 TEUs a decade ago[5].

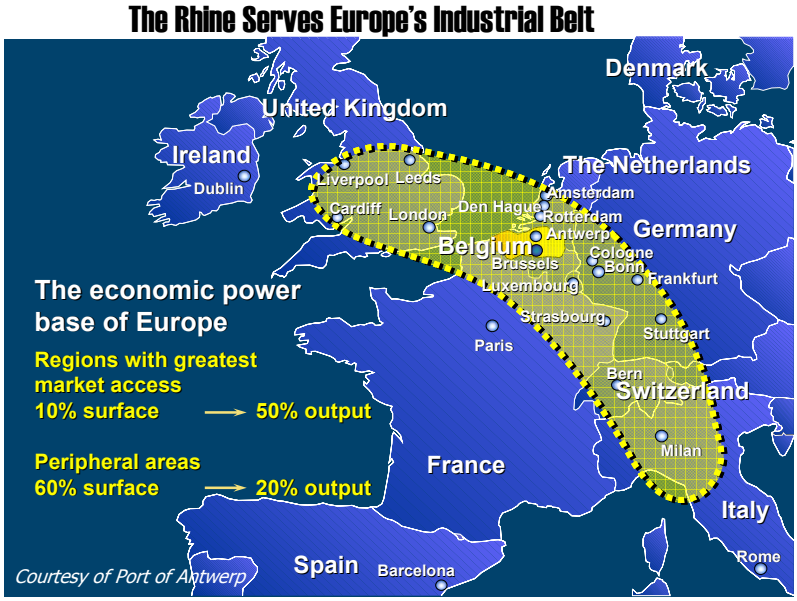
The Rhine river corridor accounts for almost half of this volume, specifically between the coastal gateway ports on the North Sea (Netherlands) and inland industrial centers, predominately Germany. The second largest COB market is between the ports of Antwerp and Rotterdam, generating 950,000 TEUs annually, followed by domestic traffic within the Netherlands, accounting for 880,000 TEU's. The fastest emerging market for COB are the inland ports that serve Belgium, where in 2005, container volumes grew by 13% to over 450,000 TEUs, up from 50,000 TEUs in 1997. The other major markets are domestic volumes within Germany (between the Port of Hamburg and inland markets) and within France (between the Port of Le Havre and Paris)[6].

[5] Hub and Spoke Networks in Container-on-Barge Transport, Rob Konings; Transportation Research Record: Journal of the Transportation Research Board, No. 1963, transportation research board of the national academy is, Washington, DC.

[6] Final Report: Container Liner Service DANUBE (COLD), August 2006; via Donau.

CASE STUDY: THE RHINE WATERWAY SYSTEM

The most dominant market for COB in Europe is along the Rhine River corridor. In 2005 approximately 1.86 million TEUs crossed the border between Germany and Holland[7]. The geographic scope of this market includes the ports of Antwerp and Rotterdam (Belgium and Netherlands, respectively) on the northeastern end and a series of inland port terminals along the Rhine in Germany, France and Switzerland on the southeastern end, as well as limited volumes from Austria using the Danube river and connecting to the Rhine via the Main river.



The Rhine River plays an important part in serving Europe's largest industrial base. It dissects Europe's economic power base which covers only 10% of Europe's surface but produces 50% of Europe's economic output. This economic region is referred to as a "banana" because of its shape, stretching from Liverpool through London, in a southeastern direction to Milan on the other end. Europe's industrial banana serves as an important generator of significant levels of container traffic, at a scale sufficient to support sustainable COB services. In addition to the major inland markets, the success of COB along the Rhine River corridor is also in part due to the location of major international gateway ports along the North Sea.

Overview of the Gateway Ports

COB services in Europe have grown predominantly to serve as a supplemental link between large and congested coastal gateway ports and their hinterland markets. In fact, the location of a major international gateway container port close to the mouth of the river is a prerequisite for a successful COB service development. In the case of the Rhine, the ports of Rotterdam and Antwerp together play the role as the international gateway. Rotterdam has historically generated the greatest volume

[7] Is Rhine Container Shipping in Dire Straits? World Cargo News, November 2006.

of COB traffic for the Rhine, totaling over 1 million TEUs in 2005, while Antwerp generated 786,000 TEUs. However, Antwerp is the fastest growing gateway port for the Rhine, with COB traffic growing at 25% annually in 2005 compared to 6.5% for the Port of Rotterdam. One reason for Antwerp's faster growth rate is that it is gaining overall container market share from Rotterdam due to its location further up the river, closer to the hinterland markets.

Tactical Approach to Mode Shift

The Ports of Rotterdam and Antwerp are ranked as among the largest in the world and therefore are some of the most congested in the world. As a result, these ports are continuously working to improve access to their markets. They view the inland waterway system as strategically integral to their long-term success. For example, approximately half of all commodities through the Port of Rotterdam move by inland waterway, and one third of all containers.

Inland Mode Shares at the Port of Rotterdam

Millions of Tons	Barge		Pipe		Road		Rail	
	Tons	Share	Tons	Share	Tons	Share	Tons	Share
Liquid Bulk	49.8	39%	1.6	1%	63.6	51%	11.6	9%
Dry Bulk	77.4	86%	4.1	5%	0	0%	7.9	9%
Containers	14.2	33%	6.8	16%	0	0%	22.1	51%
Conv. Cargo	2.2	6%	1.3	3%	0	0%	34.2	91%
Total	144	48%	13.8	5%	63.6	21%	75.8	26%

Part of the success in modal diversity at the Port of Rotterdam is based on a tactical approach of aggressively encouraging port tenants to utilize non-highway modes. Tenant leases are granted based on three sets of overall criteria, one of which is the share of traffic that the prospective tenants propose to move by non-highway modes. In other words, the port favors tenants that work with their clients to utilize a more diverse and sustainable range of modes.

Overview of an Inland Port

There are a large number of inland ports that provide COB services along the Rhine River, the largest of which is Duisburg which handled approximately 335,000 TEUs. The next largest players are the Port of Mannheim and the Port of Mainz, each of which handle approximately 120,000-130,000 TEUs annually.

Of the three ports, the Port of Mannheim provides an interesting profile with lessons to learn and apply in the United States. The Port of Mannheim serves the Rhine-Neckar European metropolitan region, with a population of approximately 24 million people and a large industrial base including the largest BASF plant in the world with over 37 thousand employees. Containers were first shipped in 1968 by the U.S. military, moving civilian cargo between Rotterdam and military installations in Germany. COB was viewed as the most secure form of transportation for these shipments. Once the military service was underway, barge operators began backhauling empty containers to Rotterdam to supplement revenue. Thereafter freight forwarders began filling the containers with shipments to Rotterdam which then progressed to full-scale commercial services. This evolution in

service was also the case for other ports along the Rhine, including Duisburg.

A typical transit time between Mannheim and Rotterdam is 26 hours, covering a distance of 500 miles with no locks as impediments. The typical barge vessel carries between 150 and 200 boxes, and can carry any kind of cargo thereby allowing barge operators the flexibility of picking up a variety of cargoes in order to sustain service. However, larger barges that carry more than 150 boxes are typically dedicated for containers only. Mannheim is a typical inland container port which provides trimodal services – highway, rail and barge. 30% of COB traffic originates and terminates by rail mostly from Spain and Switzerland. The rail facilities are on-dock providing for easier and more efficient transfer.

The Inland Barge Container Terminal at the Port of Mannheim

Courtesy of Port of Mannheim

Typical Container on Barge Operational Characteristics

The Rhine River can be divided into three zones in terms of turnaround times for vessels and transit times. The lower Rhine section, the section closest to the gateway ports, typically allows for between two and three round trips per week. The middle Rhine section typically allows for one round trip per week and the upper Rhine section typically allows for one round trip every two weeks[8]. Not surprisingly, COB volumes differ significantly between the various sections, with the highest volumes occurring on the lower sections where higher frequencies are attainable. Thus, shorter trips and higher frequencies (better quality of service to compete with trucking), produce higher volumes.

The frequency in service is essential in terms of competing with the shorter transit times offered by trucks and rail. Unlike traditional bulk oriented barge services which carry large volumes of traffic at low frequencies, COB services typically utilize smaller vessels carrying lower volumes at higher frequencies.

[8] Hub and Spoke Networks in Container-on-Barge Transport, Rob Konings; Transportation Research Record: Journal of the Transportation Research Board, No. 1963, transportation research board of the national academy is, Washington, DC.

Typical Container-on-Barge Vessel Configurations

Though the Rhine flows faster than the Mississippi, it is not as wide and therefore places a limit on the size of barge formations. The largest barge formation has six units, three long and two wide. The Mississippi River can accommodate formations with up to 50 barges. The typical European barge used for shipping containers is a single barge that is self propelled. The most common configuration is long enough to allow six 40 foot containers, four wide and three deep, which equates to approximately 72 forty-foot equivalents (144 TEUs). As a comparison, a typical jumbo barge used in the United States accommodates approximately 50 TEUs.

The Rhine does allow larger container barges, accommodating up to 400 TEUs in four layers and 500 TEUs in five layers. A growing practice on the Rhine is to combine up to four smaller container barges in a convoy, comprising one motor barge and three push barges that can accommodate over 600 TEUs in combination. The average shipment is approximately 275 TEUs per sailing. Push barge combinations allows for flexibility to service several terminals and ports, optimizing scheduling, while at the same time enhancing the economics by increasing the scale of the shipment.

Motorship/Push Barge Combinations are a Growing Practice on the Rhine

Courtesy of Port of Rotterdam

It is important to note that the smaller barges are multipurpose vessels, allowing barge operators to carry a wide range of cargoes in addition to containers. This provides smaller operators the ability to maximize their payload, especially in cases where containers are not available to fill one or more legs of a route.

Container Barge Industry Characteristics

The COB industry along the Rhine is very well developed. The fact that the industry has existed for several decades, combined with the sheer scale of volumes, has led to significant growth and restructuring among the major players. The industry is currently undergoing significant consolidation due to the ever changing market conditions, a growing need for more sophisticated services, a better

understanding of the market dynamics, and higher operating costs due to increased fuel and charter rates (capital acquisition and leasing costs for the vessels).

While there are a number of independent operators on the Rhine, the industry is dominated by major players which in effect act as shipping lines. These liner services utilize a core fleet of long-term charters as well as additional privately owned charters. As is the case on the ocean shipping side, consolidation occurs through direct acquisition and through the development of alliances between operators serving the same lanes. The advantage of the alliance is the ability to provide competitive services that fit the market while sharing the cost of providing the service among alliance members.

The larger industry players also participate and invest in inland terminal facilities, typically in partnership with the major ocean carriers for whom they provide a dedicated service, as well as in partnership with the local port authorities that own/operate the inland ports.

Unlike the landside modes such as rail and trucking which have a direct tenant relationship with the ports, barge operators do not have such a relationship with the gateway ports. For example, the gateway ports do not direct bill the barge operators for berthing and loading, but rather charge the ocean carriers with whom the barge operators have contractual relationships. The implication for barge operators is a "stepchild" relationship with the gateway ports when it comes to resource allocation in terms of providing priority for cargo-handling facilities and equipment.

Future Challenges

As is the case in any success story, there are emerging challenges for COB service along the Rhine River. Some of these challenges are perhaps lessons to be applied to the future development of COB on the United States waterway system. A telling indication are the declining growth rates for COB traffic, dropping from a rate of 17.3% in 2004 to 8.5% in 2005 and a modest rate of 4% in 2006[9]. The declining growth rate in traffic volumes correlates with declining margins for barge operators due to increasing charter rates and fuel prices.

Delays at Gateway Ports - Operational and congestion related issues at the gateway ports are also factors. Competition for equipment and labor resources at the increasingly congested gateway ports has translated into delays for the barge operators, resulting in fewer trips and reduced weekly turns. For example, a typical operation between Antwerp and Rotterdam relies on three round trips per week in order to support a viable operation. However, due to delays at the ports, these operations are reduced to five legs (2.5 turns) which undermines their operational profitability. A typical operation between Rotterdam and Duisburg allows for two round trips per week. However, during periods of the year when 'peaking" occurs at the major gateway ports, the number of turns drop to 1.5 (3 one-way legs). In order to maintain optimum economics, operators are forced to use larger vessels which lead to bigger call sizes (which negatively impacts the inland ports that are not equipped to handle larger calls). Bigger call sizes results in lower frequencies thereby reducing the barge operators' competitiveness with shorter truck transit times. A recent initiative called the

[9] Is Rhine Container Shipping in Dire Straits? World Cargo News, November 2006.

"hinterland protocol" was launched to improve coordination between the major ocean carriers, the terminal operators and the major barge operators, with the hope of reducing the incidence of delays for barge operators.

Stepchild Syndrome - The lack of dedicated facilities at the gateway ports is a growing challenge for COB service on the Rhine. While COB is viewed as an important aspect for the gateway ports, there currently are very few dedicated marine terminals for COB. While rail and highway modes typically enjoy dedicated landside facilities, barge operators typically share scarce terminal space and wharf capacity with deep sea and feeder ships. As a result, the marine terminal operators increasingly expect barge operators to meet tight schedules which further undermine the flexibility typically enjoyed by the barge industry.

Evolving Business Model - As the COB market along the Rhine continues to mature, the industry has to evolve and adjust its traditional business models. COB has been able to compete with trucking by maintaining a level of frequency and flexibility in departure times. Unlike traditional bulk barge operations which transport large volumes of traffic and hence operate at lower frequencies, container barge operations in Europe typically utilize small vessels with smaller payloads that result in more frequent operations. Flexibility in scheduling has allowed barge operators to delay departures in order to increase payload by picking up extra containers or stopping at an extra terminal, thereby enhancing revenues and covering margins. Managing payloads using this ad-hoc approach, versus systematically moving to larger vessels, tighter departure schedules and less frequent calls, have allowed the barge operators to maintain frequent enough operations to compete with trucking. The experience in Europe shows that frequency and service is the most important means for competing with the shorter transit times offered by trucks.

Cost Savings Versus Truck-Competitive Service - However, the container barge industry is being forced to pursue opportunities to cut operating costs while sacrificing frequency of service to compete with trucking. As fuel costs and charter rates continue to rise, combined with increased pressure from the gateway marine terminals to consolidate smaller batches, the industry will likely need to graduate to larger vessels to increase payloads and reduce operating costs. The downside is that larger vessels result in reduced frequency, undermining their ability to provide truck-competitive services. One strategy for maintaining lower costs with smaller vessels is to purchase the hulls of vessels manufactured offshore, particularly in China. The unfinished hulls are shipped to Europe where the higher value work of up-fitting the hull with electronics, engines, interiors, etc., is completed. The result is a lower overall vessel cost, which in turn results in lower charter rates. Another strategy for reducing costs is to utilize combination barges as described earlier. This effectively increases payload across several smaller barges, as opposed to one large barge, thereby maintaining the operator's service flexibility.

Handling Capabilities at Inland Ports - A potential blanket shift towards larger container barges raises a concern that the operational issues now evident at the gateway ports will shift to the inland ports, which are not equipped to handle increasingly larger barges. As container volumes continue to grow at the inland facilities, so do the issues, the largest of which is competition for space among competing uses, including non-maritime uses such as recreational, tourism, accommodations, etc. As a result, there is a growing trend among inland ports to build tri-modal logistics centers that combine the three modes (truck, rail, barge), with warehousing and distribution activities that occur

on site. In addition, the tri-modal centers include separate facilities and equipment for the rail and barge operations. A typical current inland barge operation utilizes the same cranes and equipment for both rail and barge operations. This creates competition and conflicts from a scheduling standpoint. For example, a barge waiting on containers from a train typically has to wait for the entire train to be unloaded before the barge can be loaded (trains typically have to adhere to a dedicated schedules). Building separate facilities for rail and barge operations at inland ports reduces such conflicts.

Global Warming and Waterway Sustainability

Declining rainfall and snowfall in the watershed areas of the Rhine River, specifically the Alps mountain range, has led to declining water levels along the Rhine. The optimal water depth to allow for barges along the Rhine is 2.5 meters. Lower than optimum water levels in 2005 resulted in significant volume reductions, as well as reductions in payload of up to 60%. The resulting impact was a decline in dedicated and reliable services, as well as less than optimal economics due to lower payloads. And because of the significant role of the waterway mode for the gateway ports, the long-term sustainability of the Rhine and the other waterways is of major concern. One response has been to evaluate the needed investments to improve the quality and the frequency of rail service between the gateway ports and the inland markets.

CASE STUDY: THE DANUBE WATERWAY SYSTEM

The Danube River is to southeastern Europe as the Rhine is to northeastern Europe. It serves as a central artery that connects Austria, Slovakia, Hungary, Croatia, Serbia & Montenegro, Romania and Bulgaria to the Black Sea and ultimately to global trade lanes. The Danube River also connects these markets to the North Sea and with the rest of the European waterway system through the Main that links to the Rhine. Together, these river systems create an international trade corridor connecting the Black Sea with the North Sea, with southeast Germany/northeast Austria as the watershed. Conceivably, traffic north of the watershed typically flows to/from the North Sea gateway ports, and traffic south of the watershed interacts with the Black Sea gateways. However, in reality freight traffic along the Danube River is not as developed as that along the Rhine. It is estimated that the Danube River is currently being utilized at 10% of its capacity.

A number of contributing factors behind the low traffic volumes include the large geographic area, the international complexities, and political factors including the recent wars, economic and social factors. The Danube also presents unfavorable navigational conditions including low water levels, ice, air draft under bridges, etc., all of which impacts the reliability and consistency of service along the river.

An Emerging Success Story

While the Danube River only accounts for 1% of Austria's container market, the bulk of which currently moves through the North Sea ports even though this route is longer and has significantly more locks (there are 60 locks westward from Vienna versus 5 locks eastward), the Danube does

present opportunities for future growth in container traffic. The overall development strategy for COB service along the Danube presents a case study for potential application in United States.

Container Port Development in the Black Sea Basin

An emerging dynamic that affects the future success of COB on the Danube is the development of container port volumes in the Black Sea basin. The port of Constantza situated on one of the Danube's tributaries feeding into the Black Sea in Romania has developed container terminal capabilities. Container volumes at the port reached a level of 770,000 TEUs in 2005, up from 450,000 TEUs in 2004, and are expected to reach 3 million TEUs by 2010. In addition, the port of Reni in the Ukraine is in the process of developing dedicated container handling facilities. The emergence of significant container gateway volumes at the mouth of the Danube River is an important development in terms of meeting some of the key prerequisites for developing COB services. As mentioned earlier, the presence of the international container gateway port at the mouth of the river is critical to the success of COB.

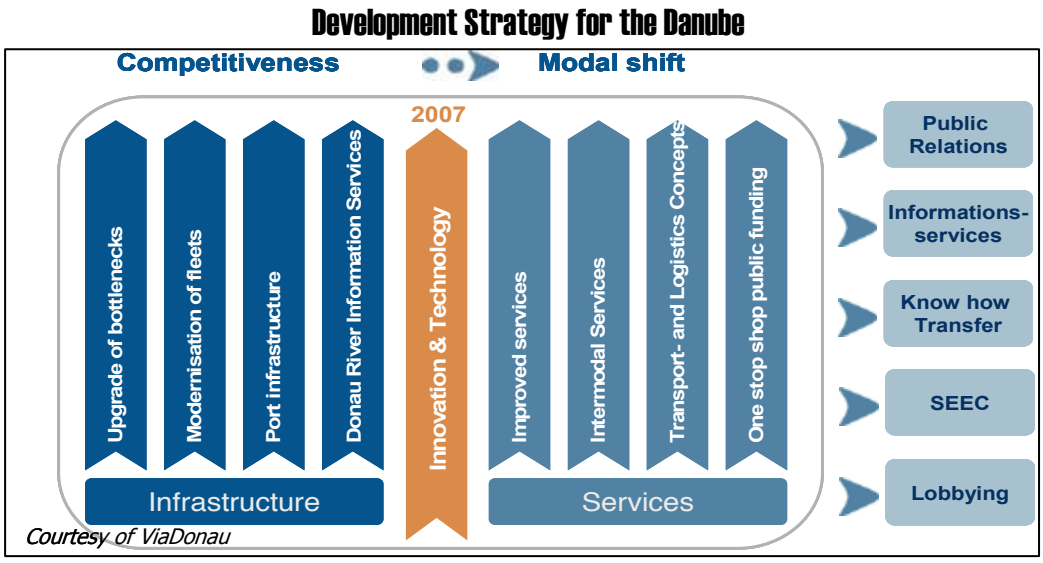
New and Potential Container on Barge Services

At least one COB service is operating on the Danube, and one is under study. The existing service operates between Belgrade (Serbia) and Constantza, connecting with ocean liner services to and from the Far East. The service operates an 80 TEU container barge that is integrated into an established general cargo and bulk barge service. This approach of integrating the container service with general barge services allows for the provision of a regular liner service but at lower throughput volumes than is normally feasible for a standalone container service. This is similar to the overall approach used to operate the Osprey Lines service in the gulf coast region, a successful U.S. based COB service which is folded into the larger bulk services operated by the parent company.

The COB service under study for the Danube (Container on Barge Service Danube – COLD) is focused on a service between port of Constantza and Krems, Austria. The prospective service under study by via Donau, the Austrian Waterway Development Agency, is planned for a capacity of 12,000 TEUs annually, using a three week round-trip service with three 120 TEU self-propelled barge and push barge combinations, resulting in a weekly service in each direction.

Proactive Government Involvement/Support

In an effort to expand the role of the Danube as a transportation corridor, the national government of Austria developed a National Action Plan (NAP) on Danube Navigation in 2005. The NAP is *a dynamic planning and decision-making instrument that will determine Austrian waterway transport* through the year 2015. The NAP stresses the importance of inland waterway navigation as a vital mode on par with highway and rail.



In order to facilitate the implementation of the development of the Danube River, the Austrian government created a Waterway Development Agency called via Donau.

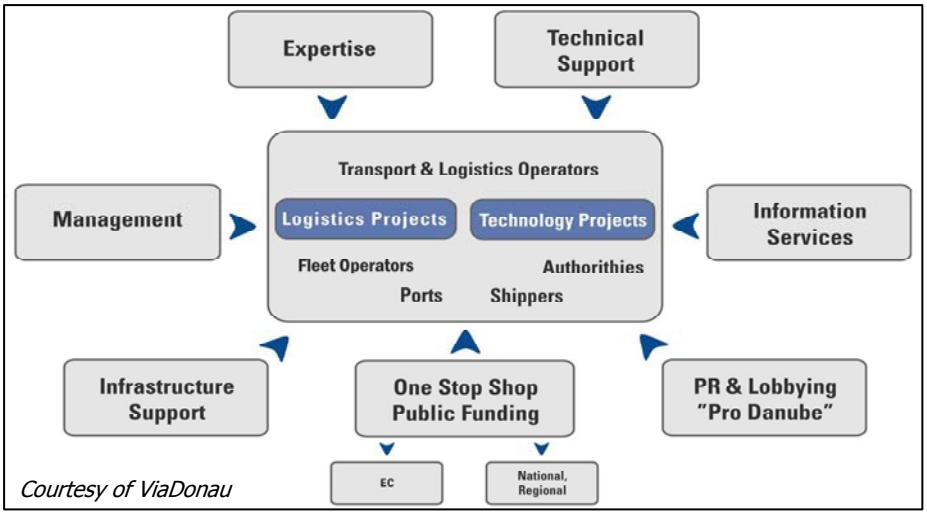
PROFILE OF AN INLAND WATERWAY DEVELOPMENT AGENCY: AUSTRIA'S VIA DONAU

Via Donau was created in 2005 by the Austrian Ministry of Transport, Innovation & Technology, and financed by the Austrian Ministry of Transport, Innovation & Technology as the country's Waterway Development Agency. It is foremost a development agency, created when artificial, non-market based subsidies proved unsuccessful. In developing its plan to develop business for the Danube River system, the use of technologies, such as the River Information Services, became a core element toward adding value to the waterway. Its mission is to increase the low utilization of the Danube waterway significantly though its modernization.

Its primary responsibilities are:

- Maintenance of the Danube waterway
- Develop and monitor projects aimed at increasing the volume of commercial and intermodal waterway traffic
- Develop and implement new technologies and systems for inland waterways
- Promote transportation by inland navigation vessels, lobby on both the national and international levels and promote strategic partnerships
- Implement pilot projects for developing axes of intermodal waterway traffic
- Carry out studies, experiments and research and management responsibilities in the above mentioned areas for third parties and in particular for the public sphere
- Operation of River Information Services (RIS)

Services Provided by Waterway Development Agencies like Via Donau



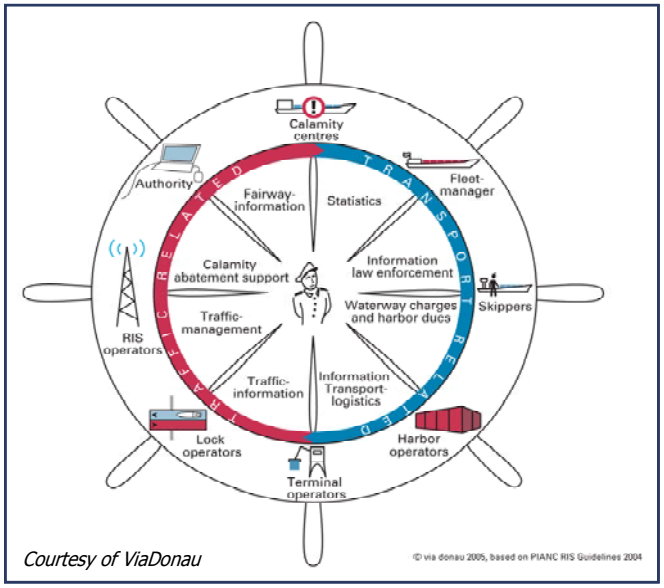
Waterway Development Agencies are not exclusive to Austria. The following are other waterway development agencies across Europe:

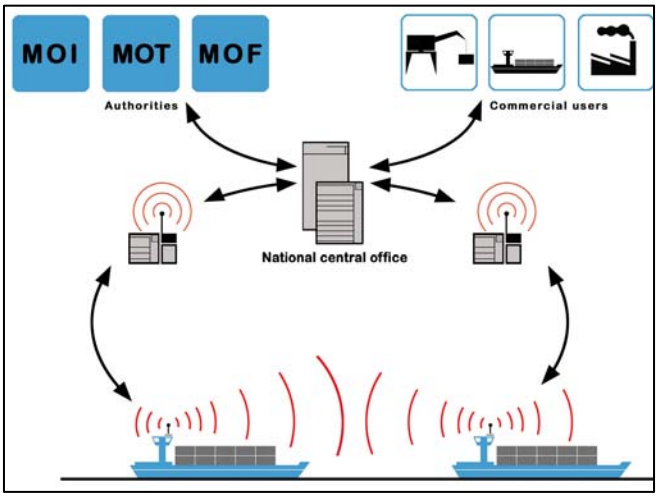
Belgium/Wallonia - OPVN - Office de promotion des voies navigables
Belgium/Flanders - PBV - Promotion Office for Inland Navigation in Flanders
Netherlands – BVB - The Inland Shipping Information Agency
France - VNF - Voies Navigables de France
Serbia - DPC – Danube Project Centre
Croatia - CRUP – Inland Navigation Development Centre

River Information Services

In 1998 the European Union created the River Information Services (RIS) program to promote and invest in the development of information and communication technologies that would help improve the competitiveness of the waterway system. The overall purpose of RIS is to connect the waterway system and transport sector into the broader global logistics supply chain for the purpose of transferring traditional bulk cargoes away from highways, as well as for attracting containers and other high price Just-In-Time cargoes. The implementation of RIS has occurred in Austria, Hungary, Serbia and Romania. Via Donau has been the lead implementing agency for the RIS in Austria, specifically along the Danube river, referred to as Donau RIS (DoRIS).

River Information Services





The DoRIS operation on the Austrian Danube was started in early 2006 with the provision of on-board equipment for commercial users. At the heart of the DoRIS program is the installation of computing and communication technologies on vessels operating on the Danube. Through the application of AIS, which is a combination of GPS for the purpose of tracking vessels and VHF for the exchange of information, DoRIS provides two tracks of services:

DoRIS Traffic Management:

- Tactical traffic image (live and historical data) based on Inland ECDIS Charts;
- Vessel position reports via GPS and communication via Inland AIS;
- Position queries for authorized users (web interface).

DoRIS Info Services web site (free access):

- Download of Inland ECDIS Charts;
- Notices to Skippers;
- Water level information.

THE MARCO POLO MODE SHARE PROGRAM

One of the goals of the European Union is to reverse the downward trend in modal market share held by the inland waterway system. The goal is to return the market shares back to pre 1998 levels by 2010. One of the programs put in place to help achieve this objective is the establishment of the Marco Polo Program in 2003.

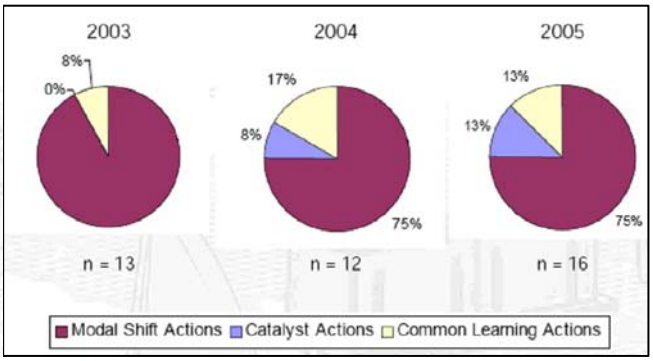
The Program's objective is to reduce road congestion and to improve the environmental performance of the freight transport system within the Community and to enhance intermodality, thereby contributing to an efficient and sustainable transport system. To achieve this objective, the Programme supports actions in the freight transport, logistics and other relevant markets. These actions should contribute to maintain the distribution of freight between the various modes of transport at 1998 levels by helping to shift the expected aggregate increase in international road freight traffic of 12 billion tkm per year to short sea shipping, rail and inland waterways or to a combination of modes of transport in which road journeys are as short as possible.

From the time of its inception in 2003 through 2006, a total budget of 100 € million was allocated for the entire group of European member countries.

Summary of Proposals Funded Through Marco Polo

	2003	2004	2005
Committed Budget (in M€)	13	20	22*
Received Proposals	92	62	63
Eligible Proposals	87	59	60
Concluded Contracts	13	12	16*
Freight to be shifted (in billion tkm)	12.4	14.4	10.0*
Environmental benefit (in M€)	204	324	254*
External costs saved (per € subvention)	15.7	15.9	11.7*

* under negotiation



The funds from this program are used to support the operating costs associated with start-up projects focused on diverting traffic away from the truck mode. Funds are not used for research and studies. Projects applying for funding are evaluated and rated based on, among other factors, the share of external costs that are successfully internalized.

Summary of Award Criteria for Marco Polo

Modal Shift Action	Catalyst Action	Common Learning Action
40 Quantity of freight shifted	40 Innovative approach	30 Improvement of co-operation, know-how and dissemination
30 Credibility and viability	30 Credibility and viability	30 Credibility and methodology
30 Environmental benefits	20 Environmental benefits	30 Innovative approach
	10 Dissemination plan	10 Environmental benefits

CONCLUSIONS & FURTHER RESEARCH

1. Market Dynamics Are Important To Success

The most successful COB operations in Europe occur along waterway corridors that connect major international gateway ports to large inland industrial markets. The Mississippi river system that feeds the entire United States heartland through its extensive network of tributaries serves a similar industrial base. The development of one or more international gateway container ports is needed to further enhance the suitability of this waterway system for COB development.

2. Policies, Incentives and Public Development Support are Critical

The European government has set in place policies specifically targeted at the development of the waterway system to reach par with the highway and rail modes. Significant investments are being made into currently underutilized waterways systems, including specific incentives and subsidies to stimulate COB services. Similar programs and resources are needed in the United States.

3. Adaptive Container-on-Barge Transport Industry

The COB transport sector has been in existence for several decades and has had to adapt to changes in competitiveness in market conditions. The industry has developed specific operating approaches so as to improve the competitiveness of their services compared to the other competing modes, including the development and utilization of vessels specifically designed to optimize the provision of cost-effective, frequent and reliable services.

4. Need for Additional Research

Further research is needed in the area of COB operations particularly given the changing market dynamics both in the United States and in Europe. Research is also needed to provide further insight into the changing aspects of the global logistics supply chain and the basic requirements for COB to remain competitive in the global context. Additional research related to new and innovative education and communication tools targeted at the potential users of the waterway system is needed.

5. Need for Continued Cooperation

Conferences, such as the recent SmartRivers 2006 that led to this report, are a model for continuing cooperation between inland waterway transportation officials, industry leaders and operators in the United States and Europe. Such cooperation should be further formalized by establishing an institutional framework based upon the original memorandum of understanding between the charter members. The purpose for institutionalizing the exchange of ideas and information is to ensure improved organization of activities and research, and for the purpose of allocating and dedicating funding to support such activities.