The Navigation Economic Technologies Program

July 1, 2003

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Recent Trends in Output, Industrial Organization, and the Willingness to Pay in the United States Inland Waterborne Commercial Transportation Industry

US Army Corps of Engineers®

IWR Report 03-NETS-R-01

Navigation Economic Technologies

The purpose of the Navigation Economic Technologies (NETS) research program is to develop a standardized and defensible suite of economic tools for navigation improvement evaluation. NETS addresses specific navigation economic evaluation and modeling issues that have been raised inside and outside the Corps and is responsive to our commitment to develop and use peer-reviewed tools, techniques and procedures as expressed in the Civil Works strategic plan. The new tools and techniques developed by the NETS research program are to be based on 1) reviews of economic theory, 2) current practices across the Corps (and elsewhere), 3) data needs and availability, and 4) peer recommendations.

The NETS research program has two focus points: expansion of the body of knowledge about the economics underlying uses of the waterways; and creation of a toolbox of practical planning models, methods and techniques that can be applied to a variety of situations.

Expanding the Body of Knowledge

NETS will strive to expand the available body of knowledge about core concepts underlying navigation economic models through the development of scientific papers and reports. For example, NETS will explore how the economic benefits of building new navigation projects are affected by market conditions and/or changes in shipper behaviors, particularly decisions to switch to non-water modes of transportation. The results of such studies will help Corps planners determine whether their economic models are based on realistic premises.

Creating a Planning Toolbox

The NETS research program will develop a series of practical tools and techniques that can be used by Corps navigation planners. The centerpiece of these efforts will be a suite of simulation models. The suite will include models for forecasting international and domestic traffic flows and how they may change with project improvements. It will also include a regional traffic routing model that identifies the annual quantities from each origin and the routes used to satisfy the forecasted demand at each destination. Finally, the suite will include a microscopic event model that generates and routes individual shipments through a system from commodity origin to destination to evaluate non-structural and reliability based measures.

This suite of economic models will enable Corps planners across the country to develop consistent, accurate, useful and comparable analyses regarding the likely impact of changes to navigation infrastructure or systems.

NETS research has been accomplished by a team of academicians, contractors and Corps employees in consultation with other Federal agencies, including the US DOT and USDA; and the Corps Planning Centers of Expertise for Inland and Deep Draft Navigation.

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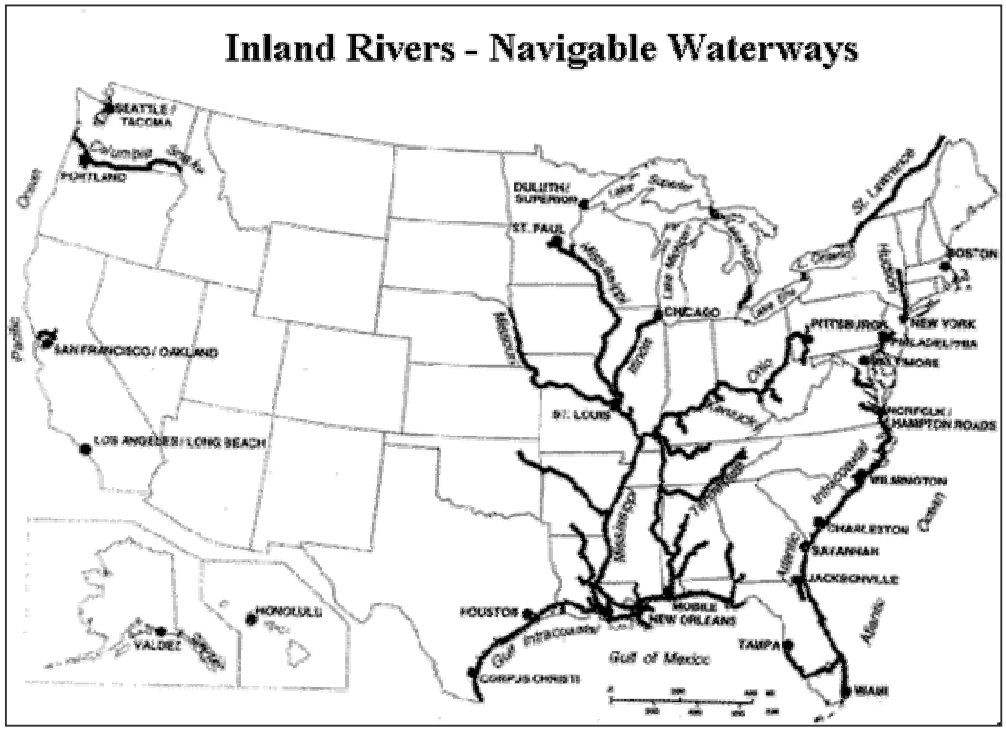
Abstract

An analysis of publicly available historic data regarding the domestic inland water transportation industry reveals a national industry best characterized by: (1) historically decreasing rates of growth in total industry output culminating in the current virtual stagnation of long term industry output levels; (2) continuing intra-industry, horizontal integration of inland water transportation providers leading to an increased concentration of industry market power into a handful of national carriers; and (3) slowly decreasing real levels of marginal willingness to pay for water transportation as evidenced by the declining real revenues per unit of output publicly reported by inland water transportation firms. Together, these three trends have profound implications for the Corps of Engineers management of the existing inland navigation system infrastructure and raise questions regarding the wisdom of planning for and implementing costly carrying capacity expanding improvements in the near future. In the current Federal fiscal environment with many competing demands for scarce Federal budget resources, these three trends also suggest a rationalization of the performance of underutilized segments of the existing infrastructure in the context of the net current national economic benefits they contribute.

Introduction

The purpose of this research is to identify and examine recent historical trends evidenced in the inland waterborne transportation industry of the United States. The paper is narrowly focused on three trends evidenced in publicly available data published for the industry: (1) trends in total industry size as measured by both the total tons transported by the industry and the total ton-miles produced (a ton-mile represents the movement of one ton of cargo a distance of one mile) by the industry; (2) trends in the industrial organization of inland water transportation as measured by the proportion of barges managed by the four largest providers of inland water transportation; and (3) trends regarding the observable willingness of shippers to pay for inland water transportation as measured by historic revenues of publicly reporting firms engaged in inland water transportation.

The nation's inland waterway navigation system is comprised of some 12,000 navigable miles of inland and intra-coastal waterways. The core of the system is composed of the primary transportation arteries of the Mississippi, Ohio, Illinois, and Tennessee Rivers and the Gulf Intra-Coastal Waterway. The balance of the system is composed of less heavily used navigable tributaries, rivers, and canals. The commodities shipped on the inland waterway system are primarily low value, bulk commodities such as coal, petroleum products, chemicals, aggregates, and raw agricultural products transported in barges. The barges are pushed through the system in groups by towboats. The map below displays the geographic extent of the United States navigable inland waterways system.



Recent Trends in Total Industry Output

The U.S. domestic barge industry has experienced little to no growth in total cargo tonnage transported since 1990. Table 1, below, displays the total internal tons, total ton-miles, and total number of barges engaged in domestic inland water transportation for the period beginning in 1990 and concluding in 2001, the most current data available. Total domestic internal tonnage carried on the Inland Waterways was 623 million tons in 1990 and 620 million tons in 2001. The peak year for total internal traffic during this period was 1997 with 631 million short tons transported internally on the domestic inland navigation system. Total internal ton-miles have increased slightly from 292 billion in 1990 to 295 billion in 2001. Total system ton-miles reached their peak level during this period in 1999. During this 12 year period, the overall domestic barge fleet has grown from a total of 21,352 barges in 1990 to some 22,430 barges in 2001. Like tonnage and ton-miles, the total number of system barges also appears to have reached its peak level of over 23,000 barges during this twelve year period in 1998.

Table 1
Domestic Internal Inland Waterways

Year	*Short Tons (millions)*	*Ton-miles (billions)*	*Barges*
1990	623	292	21,352
1991	600	290	21,249
1992	621	298	20,799
1993	607	284	21,232
1994	618	298	21,156
1995	620	306	21,280
1996	622	297	21,731
1997	631	294	22,410
1998	625	295	23,092
1999	625	305	22,949
2000	628	303	22,690
2001	620	295	22,430

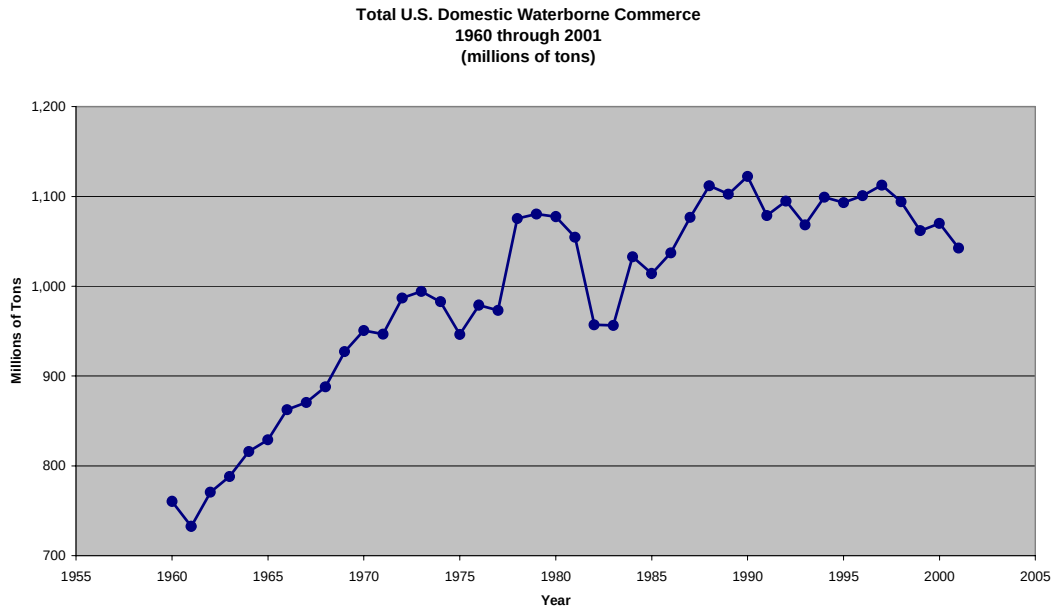
Sources: Short tons and Ton-miles from Waterborne Commerce of the United States, Calendar Year 2001, Part 5 National Totals, U.S. Army Corps of Engineers Waterborne Commerce Statistics Center and Barges from Sparks Companies, Inc. Barge Fleet Profile March 2002.

To put the recent internal barge tonnage data displayed in Table 1 in both a larger historical and transportation context Figure 1, below, presents the total annual waterborne tonnage transported in any vessel operating on any portion of the domestic water transportation system since 1960. The annual tonnage data graphically presented in Figure 1 includes not only the internal barge tonnage data, but also includes domestic U.S. ocean (termed Coastwise) movements and domestic U.S. Great Lakes (termed Lakewise) movements. Direct export tonnage is excluded from these figures. Coastwise and Lakewise movements typically do not move in inland barges, but are included in the total domestic tonnage figures presented below to provide a context for evaluating the

relative importance of internal barge movements. As evidenced in Table 1 and in Figure 1 internal barge movements comprise some 60 percent of the total domestic waterborne commerce of the United States.

During the decade of the 1960's total annual domestic waterborne tonnage enjoyed a pattern of steady growth. Annual tonnages increased almost linearly and with remarkable regularity. In the next two decades the annual total domestic waterborne tonnage generally continued to increase over time but with a much greater year to year instability as evidenced by the periods of rapid increases and decreases in the total annual domestic tonnages. In the last decade or so the total annual tonnage of domestic waterborne traffic has stagnated at levels between 1,000 and 1,100 million tons and has not exceeded the peak levels observed in the late 1980's. In fact, there is some initial evidence of the beginning of a declining trend in annual total domestic tonnage since the peak in annual tonnages was achieved in the late 1980's.

Figure 1



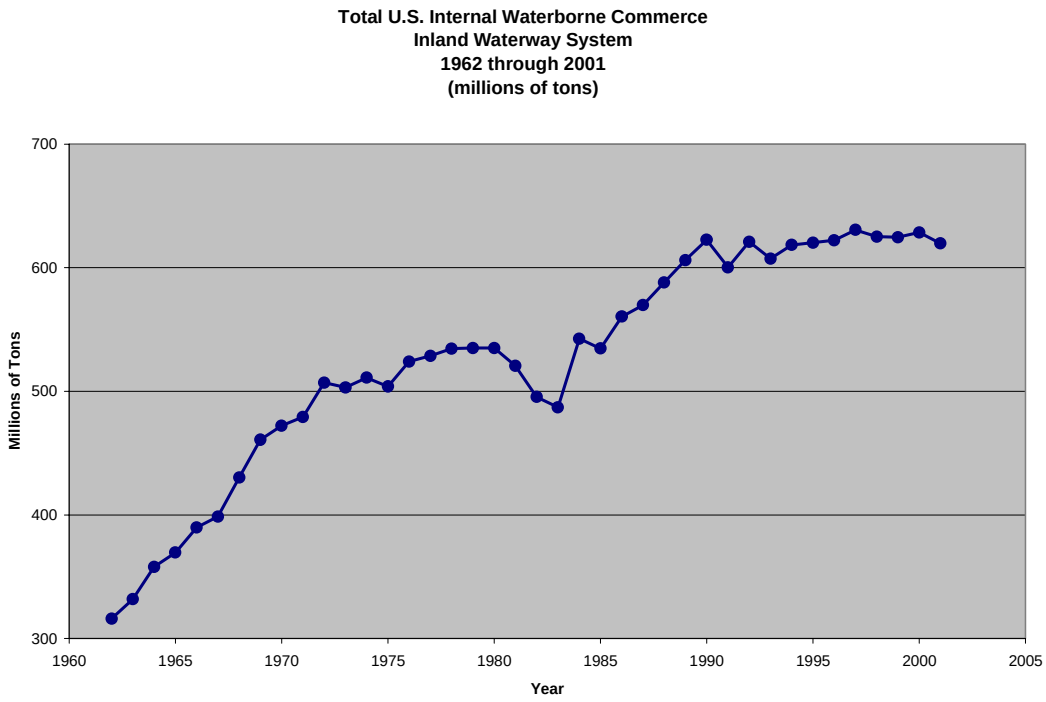
Source: Waterborne Commerce of the United States, Calendar Year 2001, Part 5 National Totals, U.S. Army Corps of Engineers Waterborne Commerce Statistics Center.

Figure 2, below, presents the total internal-only annual tonnage transported on the inland waterway system for the period beginning in 1962 through 2001. Figure 2 extends the data presented in Table 1 back in time to 1962. These internal total annual tonnages are moved almost exclusively by domestic barges operating on the inland waterway system and are a subset of the total domestic tonnages displayed in Figure 1.

The data portrayed in Figure 2 display a slightly different history for internal tonnages compared with the previous data for total domestic tonnage levels. Similar to total domestic tonnage, the internal total annual tonnage levels increased rapidly and regularly

through the 1960's. The rate of growth in total annual internal tonnage evidenced in the 1960's appears to have diminished somewhat during the decade of the 1970's but does not exhibit the same level of increased variability in changes in annual tonnages seen during that period in the corresponding time series of total domestic waterborne traffic. In the early 1980's total annual internal traffic decreased somewhat early in the decade and then recovered to again increase regularly through the duration of that decade. Similar to the time series of total domestic traffic, during the 1990's and continuing into the present, the total annual internal traffic appears to have leveled at approximately 620 million tons per year.

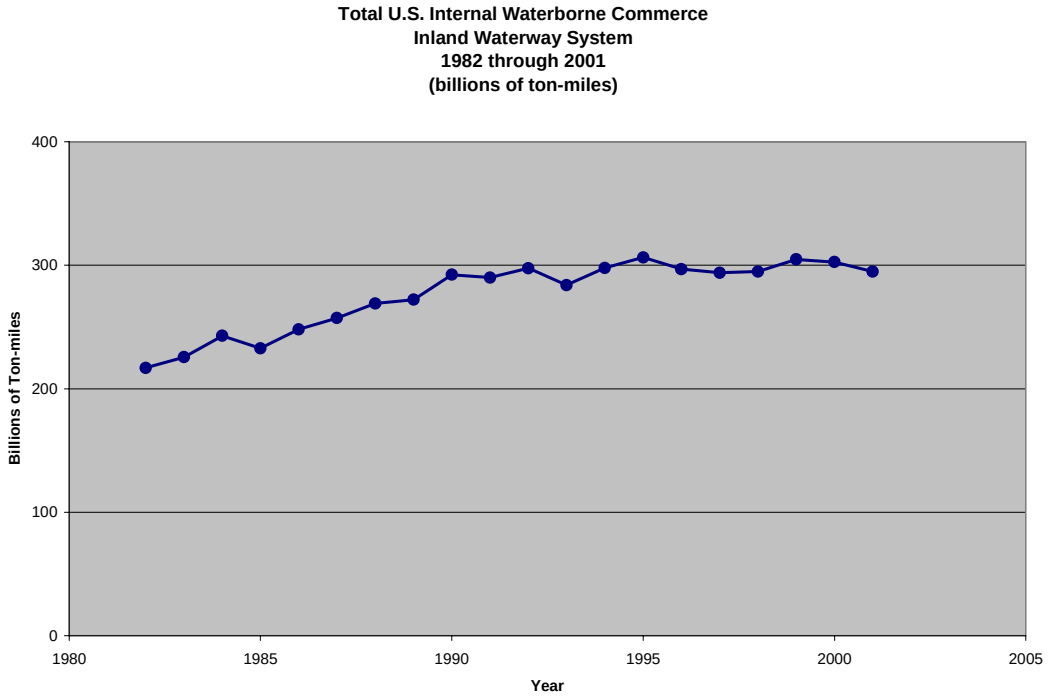
Figure 2



Source: Waterborne Commerce of the United States, Calendar Year 2001, Part 5 National Totals, U.S. Army Corps of Engineers Waterborne Commerce Statistics Center.

Figure 3, below, displays the total annual ton-miles of traffic produced on the internal segments of the inland waterway system from the period beginning in 1982 through 2001. 1982 represents the first year that internal ton-mile data was compiled for the entire system. Total annual system ton-miles increased quite regularly during the decade of the 1980's and through the early 1990's. However, since 1995 they appear to have leveled off at approximately 300 billion ton-miles per year.

Figure 3



Source: Waterborne Commerce of the United States, Calendar Year 2001, Part 5 National Totals, U.S. Army Corps of Engineers Waterborne Commerce Statistics Center.

To summarize, examination of the recent trends evident in historic data for both tonnages and ton-miles produced on the United States inland water transportation system reveals a domestic water transportation industry whose relatively stable historic rates of growth have stagnated over the last two decades at current levels. The causes for the recent lack of growth in the output of the domestic barge industry are probably quite complex and most likely related to important economic factors such as the increasing reliance on just in time inventory policies and "time certain" delivery in industries that depend on barge transportation, the decreasing, and more competitive, real rail transportation rates that have followed the passage of the 1980 Staggers Rail Act, the continuing flat demand for United States bulk agricultural exports, and the imposition of the Inland Waterways fuel tax via the Inland Waterways Revenue Act of 1978.

Recent Trends in the Industrial Organization of Barge Transportation

The domestic barge industry is composed of a wide variety of inland water transportation providers. The U.S. Army Corps of Engineers' Navigation Data Center in their Volume 2, Vessel Company Summary, 2001 Waterborne Transportation Lines of the United States lists over 1,000 firms that owned or managed barges that operated on the domestic

waterways of the United States in 2001. The characteristics of these firms vary widely over a large range of distinguishing attributes.

Some of the firms engaged in the supply of inland water transportation are privately held corporations, while others are publicly owned corporations whose stocks are traded on major equity exchanges. Some of the firms engaged in the supply of inland water transportation are "for hire" carriers that supply transportation services to many unrelated firms, while other firms are subsidiaries of larger corporations and provide dedicated water transportation services only to their parent corporations. Some of the firms engaged in the supply of inland water transportation specialize in the movement of dry bulk commodities, other firms specialize in the movement of liquid bulk commodities, and still other firms offer a complete spectrum of water transportation services. Some of the firms engaged in the supply of inland water transportation specialize in the movement of commodities on a limited number of inland waterways or system segments, while other firms offer services throughout the entire breadth of the inland navigation system. Some of the firms engaged in the supply of inland water transportation manage many thousands of barges, while still others manage only a few barges.

In the face of declining rates of growth in demand for their services, the domestic barge industry has undergone a recent period of accelerated consolidation continuing a trend that began in the early 1980's. Almost all of the recent industry consolidations have been the result of the horizontal merger of former industry competitors or the acquisition of smaller carriers by larger carriers already operating in the industry. The companies participating in these mergers and acquisitions have typically cited as their reason for merger that they were attempting to integrate their operations in order to achieve increasing economies of geographic scope, traffic density, and operating scale. Table 2 below presents the more important horizontal mergers and acquisitions in the industry that have taken place since 1995.

Table 2
Important Horizontal Mergers and Acquisitions since 1995

Firms	Year
Ingram Industries and Midland Enterprises	2002
American Electric Fuels and MEMCO Barge Line	2001
ACL and 3 ConAgra Barge Lines	2000
Hollywood Marine and Kirby Marine	1999
ACL and National Marine	1998
ACL and Continental Grain	1996

After the most recent large industry consolidation, Ingram Industry Inc.'s (some 1,700 barges and 62 towboats) acquisition of Midland Enterprises Inc. (some 2,300 barges and 80 towboats) on January 24, 2002, there are four remaining domestic barging companies that each operate more than 1,500 barges. The four companies are Danielson Holding Corporation's American Commercial Lines, LLC (ACL), Ingram Industries' Ingram Marine (Ingram), Archer Daniels Midland Company's American River Transportation

Company (ARTCO), and American Electric Power's MEMCO Barge Line (MEMCO). As evidenced by Table 3, below, these four firms together currently manage approximately 52 percent of the total United States domestic dry cargo hopper barge fleet. The 2001 data presented in Table 3 are the most recent official data regarding barge ownership and are derived from Volume 2, Vessel Company Summary, Waterborne Transportation Lines of the United States published by the Navigation Data Center, U.S. Army Corps of Engineers, 2003. Table 3 and, later, Table 5 combines the barge assets of Ingram Industries and Midland Enterprises to account for their subsequent merger in 2002.

Table 3
2001 Dry Cargo Hopper Barges

Firm	Barges	Percent
ACL	4,096	18%
Ingram	4,057	18%
ARTCO	2,053	9%
MEMCO	1,623	7%
Total Largest 4 Firms	11,829	52%
Industry Total	22,534	100%

Source: Volume 2, Vessel Company Summary, Waterborne Transportation Lines of the United States, Navigation Data Center, U.S. Army Corps of Engineers, 2003.

To examine the effects of these recent mergers on the industrial organization of the domestic barge industry, Table 4, below, displays the number of dry cargo hopper barges managed or owned by the four largest dry cargo carriers in 1997. Contrasted with the 52 percent that the four largest dry cargo carriers currently manage, in 1997 the four largest carriers controlled only 42 percent of the total dry cargo barge fleet. Clearly, there has been a significant increase in the concentration of market power in the four largest dry cargo carriers since 1997 as a result of the recent mergers and acquisitions in the industry.

Table 4
1997 Dry Cargo Hopper Barges

Firm	*Barges*	*Percent*
ACL	2,997	13%
Midland	2,499	11%
ARTCO	2,085	9%
Ingram	1,695	8%
Total Largest 4 Firms	9,276	42%
Industry Total	22,255	100%

Source: Volume 2, Vessel Company Summary, Waterborne Transportation Lines of the United States, Navigation Data Center, U.S. Army Corps of Engineers, 1999.

A similar trend towards increasing concentration of market power in a handful of firms is also evident in the liquid cargo domestic barge market. Liquid cargoes are typically transported in substantially more costly specialized equipment, commonly called tank barges, than are dry barge cargoes. The four largest transportation companies participating in inland domestic liquid cargo barge management are Kirby Corporation, American Commercial Lines, Ingram Marine, and Marathon Ashland Petroleum LLC. As presented in Table 5, below, these four firms together currently manage over 39 percent of the total domestic inland liquid cargo barge fleet.

Table 5
2001 Liquid Cargo Barges

Firm	*Barges*	*Percent*
Kirby Marine	765	19%
ACL	483	12%
Ingram Marine	165	4%
Marathon Ashland	159	4%
Total Largest 4 Firms	1,572	39%
Industry Total	4,028	100.0%

Source: Volume 2, Vessel Company Summary, Waterborne Transportation Lines of the United States Navigation, Data Center, U.S. Army Corps of Engineers, 2003.

Table 6, below, presents the total number of liquid cargo barges managed or owned by the four largest liquid cargo carriers in 1997. In 1997 the four largest carriers controlled approximately 29 percent of the total liquid cargo fleet. Similar to the trend evident in the concentration of market power in the largest operators of the dry cargo fleet, there has been a significant increase in the concentration of market power in the largest liquid cargo carriers since 1997 as a result of the recent mergers and acquisitions in the industry.

Table 6
1997 Liquid Cargo Barges

Firm	*Barges*	*Percent*
Kirby Marine	489	13%
Hollywood Marine	246	6%
ACL	226	6%
Marathon Ashland	170	4%
Total Largest 4 Firms	1,131	29%
Industry Total	3,848	100%

Source: Volume 2, Vessel Company Summary, Waterborne Transportation Lines of the United States, Navigation Data Center, U.S. Army Corps of Engineers, 1999.

To summarize, recent trends evident in both dry and liquid cargo markets indicate that the supply of national inland waterborne transportation is becoming increasingly dominated by a handful of relatively very large providers. These large national providers

are attempting to increase their operations in order to achieve increasing economies of geographic scope, traffic density, and operating scale in the face of slowing increases in the demand for their services. A consequence of the dominant barge operators merging with former competitors and acquiring smaller carriers is an increasing concentration of market power in this handful of large national water transportation providers. This continuing intra-industry integration has also been observed in the national rail and airline transportation markets as firms in those industries have combined organizations since their deregulations in attempts to capture market power and potential operating efficiencies.

Recent Trends in the Willingness to Pay for Barge Transportation

Engineer Regulation (ER) 1105-2-100, 22 April 2000, requires the National Economic Development (NED) evaluation of all potential Corps of Engineers major resource actions. This regulation is commonly referred to as the Corps planning guidance and implements for the Corps of Engineers the Economic and Environmental Principles for Water and Related Land Resources Implementation Studies, February 3, 1983, and the Economic and Environmental Guidelines for Water and Related Land Resources Implementation Studies March 10, 1983 published by the Water Resource Council. The principles define the Federal objective of water and related land resources project planning as to contribute to national economic development in a manner consistent with protecting the Nation's environment. The guidelines describe how Federal water resource planning is to be conducted, detail procedures for evaluating project impacts, introduce a system of accounts for display of the economic, social, and environmental evaluations, and outline a process to formulate projects to address identified problems and opportunities. The only mandatory account for evaluating potential Federal actions for water and related land resource implementation studies is the NED account. Contributions to the NED account of a Federal water resource project are defined as the net increases in the value of the national output of goods and services.

The measurement standard for the values of goods and services created by a Federal water resource project is defined by ER 1105-2-100 to be the willingness of users to pay for each increment of output provided by a plan. Four alternative measures for estimating the willingness of users to pay for incremental units of output are described in ER 1105-2-100. The four alternative estimates of the willingness of users to pay for incremental units of outputs are: (1) the current market prices paid by existing users; (2) the changes in users' net incomes; (3) the costs of the most likely alternative to existing use; and (4) administratively established values.

The selection of which of these four alternative measures of willingness to pay to employ in the NED evaluation of a project depends on the quantity and type of incremental output provided by a plan. For example, if the additional output afforded by a federal project is too small to have a significant effect on the existing market price, then the existing market price closely approximates the willingness of users to pay for incremental units of output. If the increased output of the project is large enough to have a significant

impact on the existing market price, then estimated values (prices) for each increment of output are required to derive the total value of the incremental output. If the output of a project is intermediate goods or services subsequently used in the production of final consumer goods and services, then the change in the net incomes of the producers of the final goods afforded by the incremental intermediate outputs of the project is the appropriate measure of willingness to pay. If the outputs of a project replace the use of some other existing good or service, then the difference in the costs of the replaced output relative to the project costs is an appropriate measure of the willingness to pay. Finally, in situations where project outputs are not marketed goods, then administratively established values may serve as proxies for social values of incremental output.

Most potential Corps of Engineers inland navigation infrastructure projects have a very small impact on the total quantity of water transportation services available in the national inland water transportation market. For example, even a very costly and extensive project currently under investigation such as expanding or replacing the existing five lock chambers at Lock 20 through Lock 25 on the Upper Mississippi River would increase the current total potential industry output by approximately 0.3 percent annually. This small increase in national output represents the incremental productivity of the approximately total 600,000 barge hours annually that are currently unproductively spent at those locations waiting in queues to use the existing lock chambers. Completely eliminating those unproductive barge hours and then "reusing" them productively to provide increased industry output represents approximately a 0.3 percent increase in the total of over 196 million available barge hours already employed in producing inland waterborne transportation. Consequently, even for very extensive and costly inland navigation system projects there is likely to be an insignificant increase in the national level of output and with market power concentrated in national carriers, existing water transportation prices serve as a very good approximation of the current willingness to pay for incremental units of increased domestic barge transportation.

Furthermore, examination of the historic trend in inland waterborne transportation market prices evaluated in the context of historic traffic demands can yield insight into the potential willingness of users to pay for future increments of system output. For example, increasing historic market prices observed in a steadily growing market lend support to the prospects of an increasing willingness of users to pay for future incremental units of system output. Conversely, decreasing historic market prices observed in a flat or shrinking market lend support to the prospects of a decreasing potential willingness of users to pay for future incremental system outputs. Hence, by examining the trend in inland waterborne transportation market prices in the context of historic traffic demands, we will gain important insight into the potential willingness of users to pay for future increments of output and, subsequently, into the NED evaluation of projects designed to eliminate or reduce future inland navigation system congestion.

Four of the largest firms engaged in "for hire" inland waterborne transportation, or their parent companies, are or were required to file periodic quarterly and annual reports with the United States Securities and Exchange Commission (SEC). These firms are: (1) American Commercial Barge Lines as a subsidiary of Danielson Holding Corporation,

American Commercial Lines LLC, and CSX Corporation; (2) Midland Enterprises as a subsidiary of Keyspan Energy Corporation and Eastern Enterprises, Inc.; (3) Kirby Corporation; and (4) MEMCO Barge Lines as a subsidiary of American Electric Power Corporation. The publicly available annual reports of these companies form the basis for the following discussion concerning recent trends in the willingness to pay for barge transportation.

It is important to note that these companies convey differing levels of detail regarding their financial and operating results in satisfying their reporting requirements to the SEC. Some large parent firms report very little detail regarding their subsidiaries' inland waterway operations omitting information such as ton-miles and tonnages, while other firms report considerably more information including data on tons shipped and ton-miles produced. All the firms, however, do report their water transportation business-segment specific revenues and some information on the physical assets, barges and towboats for example, utilized to produce those revenues. Since the two most commonly accepted measures of transportation output production, ton-miles produced and tons transported, are unavailable for all four of the reporting firms, we focus instead on the relationship between the revenues generated in the production of inland water transportation and the physical units of transportation assets employed to produce those inland water transportation revenues. Essentially, we employ the physical units of capital used to produce inland water transportation revenues as the measure of each firm's output. Furthermore, since the availability of barges to transport cargo most closely relates to the tonnages moved or ton-miles produced by the individual firms, we narrow our focus further to the annual revenues generated by the barges managed by these individual firms.

Focusing the analysis on revenues produced per unit of barge availability has the unwelcome effect of blurring the revenue comparisons between the different operators as the four firms manage very different barge fleets with respect to the cargo carrying capacity of the barges, the types and ages of the barges, and the types of commodities transported in the barges. However, as barge assets have a relatively long useful economic life of multiple decades, the composition of the individual companies' barge fleets change slowly through time and permit a useful time series for investigation of trends in the willingness to pay for water transportation for each of the companies' productive barge fleet.

American Commercial Lines, LLC operates the largest fleet of barges on the domestic inland navigation system. American Commercial Lines, LLC also operates a relatively small, but growing, fleet of barges in South America. As of January 1, 2003 ACL reported that it directly operated 5,103 barges worldwide. Table 7, below, summarizes selected domestic barge transportation asset and financial data compiled and estimated from publicly available ACL annual reports published from 1995 through 2002. ACL manages both dry and liquid cargo barge fleets and operates throughout the entire inland waterway system. ACL operates the largest dry cargo barge fleet and the second largest liquid cargo barge fleet and in 2002 reported moving a total of 71 million tons of commodities in 4,581 domestic owned or operated barge units. Note that Table 7 estimates the nominal transportation revenues per available barge hour computed from

the data in the ACL annual reports. The estimated annual barge availability (measured in hours) accounts for the addition of new equipment as it was acquired by ACL and embodies the assumption that all available barge time is employed in some productive capacity. The assumption that all available barge time is employed in some productive capacity by ACL facilitates the computation of nominal transportation revenues per available barge hour and permits us to estimate the nominal transportation revenues per available barge hour by simply dividing the total domestic transportation revenues earned by ACL in the fiscal year by the total number of estimated barge hours available to ACL to over the course of the year. While the assumption that all available barge time is employed in some relatively productive capacity by ACL is not reflective of the fact that all physical equipment requires some amount of non-productive downtime (barges require very little), as long as the operating policies of ACL remain relatively consistent through the reporting periods, then the nominal transportation revenues per available barge hour provides a consistent measure of output throughout the period of analysis.

Table 7
Selected American Commercial Lines LLC Annual Data

	Domestic Barge Revenues	Domestic Dry Cargo Barges	Domestic Tank Barges	Total Barges	Boats	Estimated Available Barge Hours	Revenues per Barge Hour
Year	Millions	Units	Units	Units	Units	Millions	Dollars
2002	$582.0	4,160	421	4,581	187	41.76	$13.94
2001	$636.0	4,518	436	4,954	187	43.57	$14.60
2000	$592.0	4,539	455	4,994	200	40.56	$14.60
1999	$554.0	3,664	456	4,120	191	36.10	$15.35
1998	$469.0	3,666	456	4,122	188	33.79	$13.88
1997	$451.0	3,350	242	3,592	133	31.11	$14.50
1996	$481.0	3,280	231	3,511	133	28.70	$16.76
1995	$420.0	2,992	236	3,228	116	26.38	$15.92

Sources: 2002 - 1998 American Commercial Lines LLC SEC 10-K405 Reports, 1998 American Commercial Lines LLC SEC S-4 Report, and 1995 CSX Annual Report.

Estimating the transportation revenues per available barge hour permits a comparison of the real revenue data presented here with the "costs per hour of delay" data typically utilized in Corps of Engineers inland navigation system feasibility reports as the proxy for the willingness of users to pay for water transportation. Another useful reason for reporting the transportation revenues on an available barge hour basis is that it also facilitates a simple, market based, evaluation of the current NED value of eliminating unproductive barge time in an existing navigation system. For example, as discussed above, the current delays at Lock 20 through Lock 25 on the Upper Mississippi River total approximately 600,000 barge hours per year and, given the over 196 million barge hours currently available annually in the system, eliminating all those current delays would have a very small effect on the total national market potential output. Consequently, existing water transportation market prices serve as a very good

approximation of the current willingness to pay. Hence, eliminating the 600,000 barge hours of delay would have an estimated national economic development value of some $8.5 million per year when valued at the prices that ACL customers actually did pay in 2002. Of course in this straight-forward computation, we do not account for the increased costs that may occur to productively re-use those barge hours such as increased fuel usage costs or the costs associated with an increase in delays that might be created at other related system locks. However, this estimate is a useful bound on how large the direct transportation related NED benefits can be when valued at existing market prices. This kind of computation is not intended to supplant the more detailed NED computations produced in Corps of Engineers inland navigation system analyses, but it does provide a simple reality check regarding the results of the more detailed Corps models.

Table 8, below, displays similar selected operating data for the inland marine business operating unit of Kirby Corporation. In contrast with American Commercial Lines, Kirby Corporation operates only liquid cargo barges throughout the inland navigation system. There is a very large premium evident in the revenues per available barge hour that a Kirby liquid cargo barge can generate when compared to a dry cargo barge operated by American Commercial Lines. This large premium is the consequence of many factors including the typically greater value to weight ratio of liquid waterborne cargos in comparison with waterborne dry cargos, the significantly more costly and specialized equipment required to safely transport liquid cargoes, and the significantly smaller tow sizes employed in moving liquid cargo barges in dedicated tows. As Table 8 also clearly shows, Kirby Corporation, like American Commercial Lines, has been rapidly expanding the scope and scale of its inland waterborne transportation activities since 1998. However, through this expansionary period Kirby has continued to specialize in the waterborne transportation of liquid cargoes.

Table 8
Selected Kirby Corporation Annual Data

	Domestic Barge Revenues	Dry Cargo Barges	Tank Barges	Total Barges	Boats	Estimated Available Barge Hours	Revenues per Barge Hour
Year	Millions	Units	Units	Units	Units	Millions	Dollars
2002	$450.3	0	911	911	215	7.75	$58.11
2001	$481.3	0	858	952	214	7.53	$63.95
2000	$443.2	0	871	871	215	7.24	$61.25
1999	$291.0	0	781	781	230	5.15	$56.53
1998	$244.8	0	523	523	128	4.56	$53.65
1997	$256.1	0	519	519	127	4.55	$56.33

Sources: 2002 - 1998 Kirby Corporation SEC 10-K405 Reports.

Table 9, below, displays similar selected annual operating data for MEMCO Barge Lines, the inland waterways transportation business operating unit of American Electric Power

Corporation. MEMCO Barge Line specializes in the movement of dry bulk cargoes and does not own or manage any liquid cargo barges.

Table 9
Selected AEP MEMCO Barge Line Annual Data

	Total Barge Revenues	Dry Cargo Barges	Tank Barges	Total Barges	Boats	Estimated Available Barge Hours	Revenues per Barge Hour
Year	Millions	Units	Units	Units	Units	Millions	Dollars
2002	N/A	1,922	0	1,922	83	16.84	N/A
2001	N/A	1,805	0	1,805	45	15.81	N/A
2000	$170	1,200	0	1,200	30	10.51	$16.20
1999	$141	1,200	0	1,200	20	10.07	$14.00
1998	$125	1,100	0	1,100	21	8.76	$14.22
1997	$106	900	0	900	27	7.01	$15.05
1996	$86	700	0	700	20	5.69	$15.17
1995	$86	600	0	600	30	5.26	$16.36

Sources: 2002 - 2001 American Electric Power Corporation SEC 10-K405 Reports, 2000 Florida Energy Progress Corporation SEC 10-K405 Report.

Table 10, below, displays similar selected operating data for Midland Enterprises, which merged with Ingram Industries in 2002. Ingram Industries is a privately held corporation and does not publicly report financial operating results, however, prior to the merger with Ingram; Midland Enterprises was an operating unit of KeySpan Corporation and, before that, of Eastern Enterprises, Inc.

Table 10
Selected Midland Enterprises Annual Data

	Total Barge Revenues	Dry Cargo Barges	Tank Barges	Total Barges	Boats	Estimated Available Barge Hours	Revenues per Barge Hour
Year	Millions	Units	Units	Units	Units	Millions	Dollars
2000	N/A	2,436	0	2,436	83	21.34	N/A
1999	$267	2,436	0	2,436	86	21.24	$12.58
1998	$261	2,414	0	2,414	87	20.66	$12.64
1997	$269	2,302	0	2,302	87	20.73	$12.99
1996	$302	2,430	0	2,430	87	21.29	$14.18
1995	$296	2,430	0	2,430	116	21.29	$13.92

Sources: 2000 - 1996 Eastern Enterprises Corporation SEC 10-K405 Reports.

Figure 4, below, graphically presents the data displayed in Tables 7 through 10, above, with the historic revenues generated per available barge hour adjusted for inflation to 2002 price levels using the annual implicit GDP price deflator. The premium in hourly revenue per available barge hour that is generated by liquid cargo barges as represented by Kirby Corporation's revenue and liquid cargo fleet is clearly evident in the graph. The other three firms earn very similar revenues per available barge hour.

Figure 4

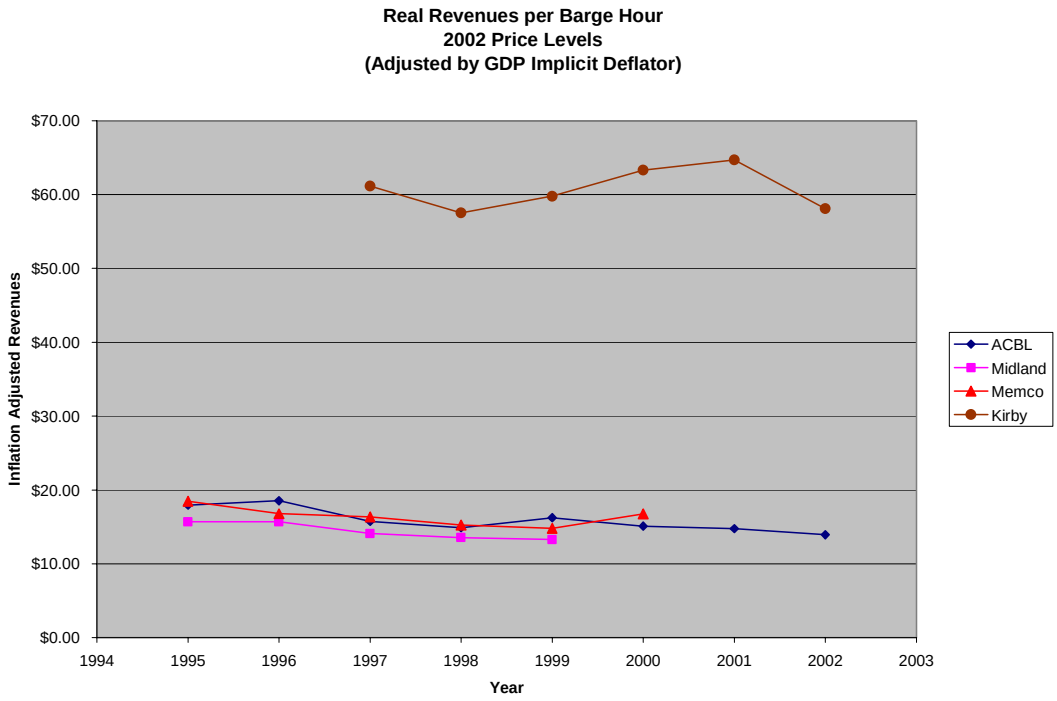
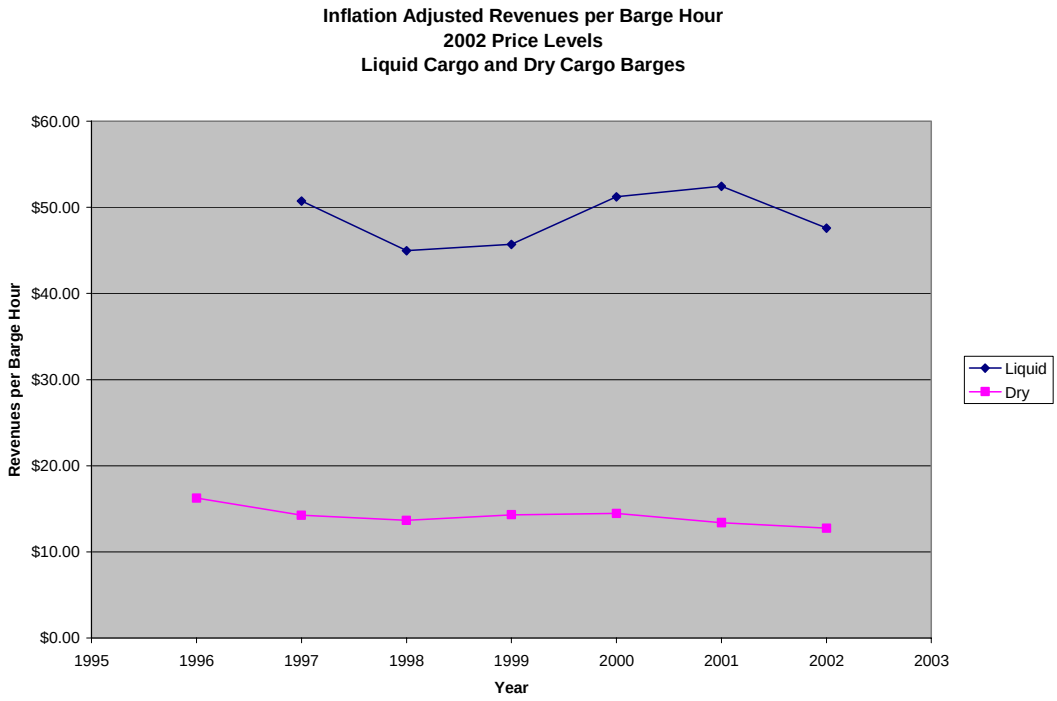


Figure 5, below, recombines the data presented in Tables 7 through 10, above, and graphically presents the inflation adjusted revenues per available barge hour for liquid cargo and dry cargo barges separately without distinction of operating company. Again, the historic revenues are inflated to 2002 price levels using the annual implicit GDP price deflator.

Figures 4 and 5 both reveal a continuing and very wide differentiation in the willingness of users to pay for water transportation between liquid and dry cargo shipments. Also evident in the data is a slow decline in the real willingness to pay for dry cargo water transportation as measured by the decreasing hourly revenues earned by dry cargo barges. It is difficult to identify any recent trend in the willingness to pay for liquid cargo water transportation given the relatively large variability in the real revenues per hour earned by liquid cargo barges, but as liquid cargo barges comprise less than 15 percent of the market it seems likely that the recent overall trend in real willingness to pay most closely follows the trend of the dry cargo sub-market.

Figure 5



Figures 4 and 5 viewed in the context of the January 31, 2003 Chapter 11 reorganization bankruptcy petition of American Commercials Lines LLC also have important implications for the future growth prospects of the commercial inland waterborne transportation industry. In Part I, Item 1 of their 2002 Annual SEC 10K-405 report filed with the SEC in March 2003, ACL management explains their bankruptcy petition with, "During 2002 and the beginning of 2003, ACL experienced a decline in barging rates, reduced shipping volumes and excess barging capacity during a period of slow economic growth and a global economic recession. Due to these factors, ACL's revenues and earnings did not meet expectations and ACL's liquidity was significantly impaired and it was unable to comply with its various debt covenants." In other words, faced with the diminished willingness of its customers to pay for its water transportation services, ACL could not service the debt that it had incurred to provide those services. If ACL, the nation's largest inland water transportation provider, cannot service its existing debt in the face of the decreasing trend in willingness to pay, the prospects of other operators to finance the significant capital expansions required for future industry growth from future revenue streams are dubious at best. The industry is literally being squeezed in the economic vise formed by the decreasing willingness of users to pay for its services and its decreasing inability to service the long-term debt incurred to provide those services. This is not an economic environment conducive to sustainable, long-term, industry growth.

Conclusions

The analysis of recent trends evident in publicly available historic barge industry data reveals a current United States domestic barge industry best characterized by:

(1) Decreasing rates of growth in total industry output culminating in the current stagnation of long term industry growth trends;

(2) Continuing intra-industry integration leading to an increased concentration of domestic water transportation market power into a handful of large national carriers; and

(3) Slowly decreasing real levels of the willingness of shippers to pay for water transportation as evidenced in the declining real revenues per unit of barge output reported publicly by firms providing inland waterborne transportation.

Together these three recent trends paint a picture of a mature national inland water transportation industry faced with diminished prospects for continued growth. In response to the diminished prospects for future growth and the decreasing trend in the real economic valuation of its services, the industry is reacting by undergoing intra-industry consolidations which are in turn increasing the concentration of market power exercised by the largest national carriers.

These trends also have profound implications for the Corps of Engineers management of the inland navigation system transportation infrastructure and suggest a management strategy focused on efficiently operating, maintaining, and rehabilitating the existing infrastructure. These trends suggest a cautionary attitude towards any management strategy focused on adding any additional carrying capacity to the infrastructure of the system to accommodate potential future growth in system traffic. Planning for and implementing costly capacity expansion measures just doesn't make sense in the economic environment of a consolidating inland water transportation industry actively attempting to shed excess long run capacity in the face of near flat or diminishing national levels of demand for their services. Similarly, management strategies focused on reducing future levels of system congestion resulting from increased system traffic should be viewed with increased skepticism in light of these trends.

To efficiently manage the infrastructure in the industry environment suggested by these recent trends, the Corps should refocus its available resources towards identifying and implementing system efficiency measures that afford clear and immediate benefits to system users in excess of the costs to the nation of implementing the measures. Low cost, system measures, including non-structural and demand management measures, have the best chance of improving the economic efficiency of the system in a low or no traffic growth environment and, consequently, relatively inexpensive measures designed to immediately improve the operating efficiency and reliability of the existing system should be vigorously pursued and implemented whenever their immediate benefits exceed their immediate costs.

Further, in an industry characterized by decreasing real national economic values for its marginal output, underutilized and low use segments of the existing inland waterway system should be re-evaluated with respect to their current and prospective contributions to the national economy. Typically these underutilized and low use segments are costly to operate and maintain per unit of national transportation services that they afford and the industry and national economy may be better served by re-directing the Federal resources used to operate and maintain underutilized and low use segments towards operating, maintaining, rehabilitating, and improving the reliability of the more heavily utilized arterial segments that comprise the core of the inland navigation system.

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The centerpiece of these efforts will be a suite of simulation models. This suite will include:

- A model for forecasting **international and domestic traffic flows** and how they may be affected by project improvements.
- A **regional traffic routing model** that will identify the annual quantities of commodities coming from various origin points and the routes used to satisfy forecasted demand at each destination.
- A **microscopic event model** that will generate routes for individual shipments from commodity origin to destination in order to evaluate non-structural and reliability measures.

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