

Southwest Region University Transportation Center

**Use of Containers to Carry Bulk and Break Bulk
Commodities and Its Impact on Gulf Region
Ports and International Trade**

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16. Abstract <p>The University of New Orleans Transportation Institute was tasked by the Louisiana Transportation Research Center (LTRC) in mid-2012 to assess the use of containers to transport bulk and break bulk commodities and to determine what their impact would be on ports within Louisiana and along the Gulf Coast once the Panama Canal Expansion (PCE) is complete in 2015. LTRC's principal interest was on the impact of the growing container trade in the emerging maritime and international trade world as a result of the PCE and the resultant all-water routes to/from Asia via Gulf Coast and U.S. East Coast ports. They were primarily interested in the impacts of shipping services calling on Gulf ports, specific import and export commodities shipped by container, and the identification of specific commodities shipped by container which can grow and under what circumstances.</p>					
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ABSTRACT

Objective

The overall objective of this study is to assess the impact of all-water Asian service on ports along the U.S. Gulf Coast due to the Panama Canal Expansion (PCE) and the resultant growth of the container trade in these ports. The potential impacts on coastal, river, and inland ports in Louisiana are also assessed as they all may be affected. However, to put these specific impacts in context, the University of New Orleans Transportation Institute (UNOTI) first investigated the impacts of the PCE on shipping services and coastal port infrastructure along both the east and west coasts of North, Central, and South America, as well as the Gulf ports. A detailed spreadsheet of port specific actions and expenditures made in anticipation of the expansion of the Panama Canal is included as Appendix A. Impacts on selected ports and commodities, both imports and exports, have also been assessed based on historic performance and informed speculation to the year 2020. Secondly, UNOTI assessed the impact of new shipping services calling on Gulf ports. The researchers investigated both import and export commodities shipped by container and determined which commodities can grow in Louisiana ports and/or what measures must be taken in order for this growth to occur. A select Project Advisory Board, representing a broad cross section of transportation leaders in Louisiana from both the public and private sector, was convened to review the findings of this research project.

Methodology

Numerous studies have recently been published on the impacts of the Panama Canal Expansion on specific ports or regions, both domestic and international, but none, to date, have been devoted to the impacts on Gulf Coastal ports or on import and export commodities shipped by container in the region. Many of these past studies were based on theoretical models. UNOTI used in-depth interviews with professionals actively involved in international shipping, representing both the public and private sector, to formulate impact assessments. These were also based on previous professional networks that UNOTI developed over the past decade within the region and a professionally diverse Project Advisory Board. This project is heavily weighted in qualitative research methods with quantitative tools used as support mechanisms. It has also been influenced by daily reviews of journal articles, industry news releases, announcements by LED of industrial plant expansions, and newspaper articles. Given the almost daily changes in the maritime shipping industry and the world energy market, the impacts of the PCE were taken into an evolving context. These changes include the growth of export commodities through the Lower

Mississippi River and the current energy revolution in the United States caused by the growth of Liquefied Natural Gas (LNG) being used both as an industrial feedstock in the chemical industry as well as an emerging export energy commodity.

Research Results

Along the Gulf Coast, the PCE will have a significant impact on the Port of Houston Authority which is spending a total of 1.83 billion dollars preparing for significantly greater cargo volumes resulting from the project. Although the ports of New Orleans and Mobile are also anticipating increased numbers of containers as a result of the PCE, industry leaders and port officials are uncertain of the actual impacts. The Port of New Orleans is currently in a multi-phase Napoleon Avenue Container Terminal Expansion program which is envisioned to allow for an increase of 960,000 TEUs in additional annual capacity. The Port of Mobile has also spent over 700 million dollars to prepare for increased container volumes as a result of the PCE. However, in light of recent and ongoing announcements by LED of major investments in plant expansions or upgrades within the Lower Mississippi River, the development of new or expanded bulk commodity terminals, and the newly licensed Liquefied Natural Gas Export Terminals being built in the Lake Charles Region, for the state of Louisiana, the additional size and capacity increases of vessels, including LNG tankers, that will be able to use the PCE are the most significant impacts, not the growth of the container trade.

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IMPLEMENTATION STATEMENT

There currently exist numerous initiatives directly related to maritime commerce, international trade, and marine infrastructure enhancements that will positively impact Louisiana. These need to be strongly supported by Louisiana Department of Transportation and Development (DOTD), Louisiana Department of Economic Development (LED), the World Trade Center of New Orleans (WTCNO) as well as elected officials at all levels of government. The following are recommended.

Support the port of New Orleans in their efforts to have the Army Corps of Engineers dredge the river bottom next to the Napoleon Avenue Container Terminal to match the depth of the Mississippi River Navigation Channel.

Support the Big River Coalition's proposal to dredge the Mississippi River downriver of Baton Rouge to a depth of 50 ft. as was evaluated by Tim Ryan, Ph.D., in his recently released report co-sponsored by DOTD. Dr. Ryan estimates that every dollar spent on this effort would return \$89.40 in benefits. This report was summarized in a recent Times-Picayune article that was posted on August 22, 2013 [1]. It should be noted that Dr. Ryan's study strictly addresses economic impact and not the geotechnical or hydrological feasibility of the deepening project.

Support and closely monitor the ongoing Master Plan for International Commerce being developed under the direction of LED, their consultant and the Task Force recently appointed by Governor Jindal. This effort has been awarded a \$1M grant from the Commerce Department and 1.6M from the U.S. Small Business Administration's State Trade and Export Promotion program [2].

Support the Realize America's Maritime Promise (RAMP) Act legislation in the U.S. Congress. U.S. Congressman Charles W. Boustany, Jr. MD (R-Southwest Louisiana) introduced in January 2011 the RAMP Act that guarantees that funds collected annually by the Harbor Maintenance Tax on imports at U.S. ports are allocated by Congress for the sole purpose of dredging and maintenance. This bill is co-sponsored by Louisiana Republicans Rodney Alexander, Bill Cassidy, Steve Scalise and John Fleming. The Senate version has 21 co-sponsors including both Louisiana Senators: David Vitter and Mary Landrieu.

The potential growth of bulk exports from Louisiana is unprecedented in the history of the state, given the diversified investments in the energy and petrochemical sectors currently

occurring and the growth of traditional export commodities envisioned in the future. DOTD should investigate a publicly funded investment program to enhance the export of bulk commodities in all forms of transportation. This program should complement the massive investments in plant expansions, private terminals and related infrastructure presently being made by the private sector (both domestic and international) along the coast, primarily in the Lake Charles area and along the Lower Mississippi River between New Orleans and Baton Rouge.

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INTRODUCTION

The University of New Orleans Transportation Institute was tasked by the Louisiana Transportation Research Center (LTRC) in mid-2012 to assess the use of containers to transport bulk and break bulk commodities and to determine their impact on ports within Louisiana and along the Gulf Coast. LTRC's principal interest was on the impact of the growing container trade in the emerging post-Panamax world as a result of the Panama Canal Expansion (PCE) and the resultant all-water routes to/from Asia via Gulf Coast and U.S. East Coast ports.

An Overview: History and Existing Condition of the Panama Canal

In 1914, the existing Panama Canal was completed and caused a revolution in the international shipping industry. Today it remains a 77.1 kilometer set of parallel canals with locks at both the Caribbean Sea and the Pacific Ocean. Until 1999 the Panama Canal and the Panama Canal Zone were controlled by the United States, but both were transferred to the government of Panama in that year. The Panamanian government in turn created the Panama Canal Authority to manage the waterway and its expansion. Annual vessel transits currently average 14,000.



Figure 1
Existing Panama Canal Locks

(Photo: Marc Howlett July, 2013)

The existing lock dimensions preclude many vessels, including the newly built post-Panamax class of container ships (having a capacity of in excess of 12,600 TEUs) from using the existing canal. Hence, the impetus for its expansion was the dimensional limitations of the existing canal lanes.

Today, the Panama Canal can transit containerships with a total capacity of only 4,800 TEUs according to the Panama Canal Authority. It currently serves cargo vessels up to 85,000 dead weight tons (dwt) and only 8 percent of the LNG tanker fleet. With the existing parallel channels and locks at both ends, the capacity of the existing Panama Canal is limited by the physical dimensions of the vessel: maximum length = 286.9m; maximum width = 32.31m; depth 12.04m; air draft = 59.91m. A shuttle railroad running parallel to the existing canals connects the Pacific side with the Caribbean side and handles roughly 2M TEUs per year.

The Panama Canal Authority posted new canal tolls on April 24, 2012 which increased the rate paid by seven types of large vessels by 15 percent over two years; for small vessels the increase was between 60-113 percent effective July 1, 2012. The Authority has yet to determine the tolls for the expanded pair of locks. In Figure 2, below, the original locks are at the upper right; the PCE is in the lower left.



Figure 2
Rendering of completed PCE
(c/o Panama Canal Authority)



Figure 3
PCE under construction

(c/o Marc Howlett 2013)

The Panama Canal Expansion

This \$5.25 billion project is building a third set of locks as well as a parallel canal linking the Pacific Ocean with the Caribbean Sea, which will allow an all-water route via the expanded canal to ports along the Gulf Coast as well as along the Atlantic Coast for a significantly larger percentage of the world's vessels. Completion is scheduled for late 2015. When it becomes operational, the capacity of the canal will double, allowing bigger, deeper, and wider ships (maximum 120,000 dead weight tons (dwt) to utilize the facilities.

Containerships, now estimated at 12,600 twenty-ft. equivalent units (TEUs), will be able to transit the Third Locks as well as 80 percent of the world's LNG tanker fleet. Even today, 10 percent of merchant fleet vessels are too large to use the Panama Canal Expansion due to its dimensional limitations. Cargo volumes transiting the PCE are projected to grow +3 percent per year with the advent of the post-Panamax fleet, according to the Panama Canal Authority.

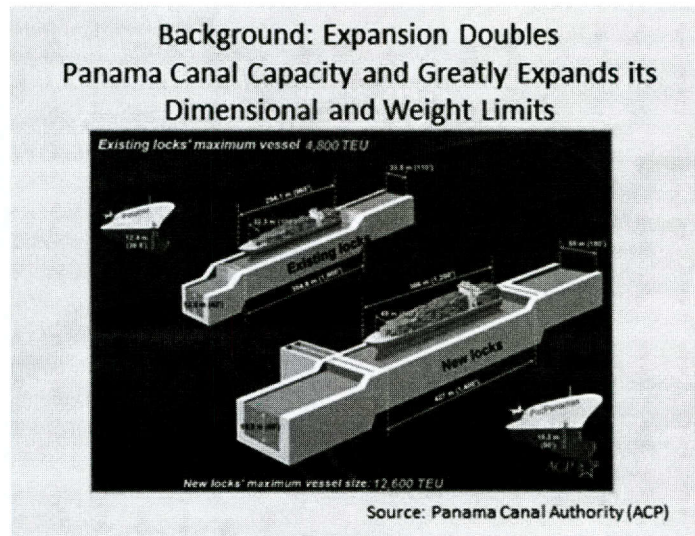


Figure 4
An illustrative comparison
(c/o Panama Canal Authority)

The change in ship dimensions that the Expanded Canal will accommodate is summarized in Table 1.

Table 1
Summary of Old / New Panamax dimensions (Panama Canal Authority, 2010)

	Length (m)	Beam (m)	Draft (m)	Air Draft (m)
Old Panamax	289.6	32.31	12.04	57.91
New Panamax	366.0	49.0	15.2	57.91

In terms of ship capacity, the new Panamax vessels are shown in Table 2.

Table 2
Summary of changes to panamax vessels

Sector	Existing panamax	New panamax
Container	<ul style="list-style-type: none"> • About 4,800 TEU • Beam-limited 	<ul style="list-style-type: none"> • About 13,200 TEU • Length-limited
Dry Bulk	<ul style="list-style-type: none"> • About 85,000 dwt • Beam-limited 	<ul style="list-style-type: none"> • Capesize in ballast • About 120,000 dwt laden • Draft-limited
Tanker	<ul style="list-style-type: none"> • About 80,000 dwt • Beam-limited 	<ul style="list-style-type: none"> • Suezmax in ballast • About 120,000 (afamax) laden • Draft-limited

Source: Paul W. Stott, School of Marine Science & Technology, Newcastle University, Newcastle, UK, *Low Carbon Shipping Conference 2012: New panamax and its implications for ship design and efficiency.*

For Louisiana ports and those along the Gulf Coast, these increased dimensional and weight limits are the most important determinants for vessels that will use the PCE. As noted by John Hyatt, Vice President of New Orleans based Irwin Brown & Company, a Customs Broker and Freight Forwarder, "bulk ships will shift from being beam-constrained to draft restrained." [3] The magic number for draft is 15.2m (50 ft.), a depth many ports in the Americas are currently spending billions of dollars to achieve.

LTRC Project 13-7SS

UNOTI began this investigation by examining the current use of containers for bulk and break bulk commodities in the region. In Louisiana and in ports along the Lower Mississippi River (LMR), the use of containers for bulk or break bulk commodities is minimal. UNOTI researchers also talked with industry leaders and commodity dealers regarding potential new markets for container cargoes. They expressed little optimism, in part based on bad experiences with containers in the past: namely, the poor condition of the containers or the difficulty in locating either containers or drivers along the Gulf Coast. This is a common problem with rice mills in southwest LA. However, in 2011, New Orleans-based Transportation Consultants Inc. (TCI) began a high-tech packaging operation for plastic resins which are bagged, stacked, and sealed automatically at their existing plant next to the Industrial Canal. The bagged product is then stuffed into containers and trucked to their

Esplanade Wharf facility for export. Currently, TCI also imports granite using the same facilities. The Kearney Companies, located immediately adjacent to TCI at the Industrial Canal, also stuff containers for export. In November 2013, S3 Pacorini Logistics announced their intent to import fracking sand by container at the Port of New Orleans [4]. A related company has operated a successful coffee importing/roasting facility at their Silocaf facility along the Uptown wharves in New Orleans for a number of years. Until now, they have never ventured from their core business. Fracking sand or similar proppants may be an emerging commodity for containers at the Port of New Orleans.

UNOTI has also compiled a comparative spreadsheet of all port related investments that are being made within the Americas to prepare for a post-Panamax world. See the Appendix.

OBJECTIVE

The overall objective of this study was to assess the impact of all-water Asian service on ports along the U.S. Gulf Coast due to the Panama Canal Expansion (PCE) and the resultant growth of the container trade in these ports. The potential impacts on coastal, river, and inland ports in Louisiana were also assessed as they all may be affected. However, to put these specific impacts in context, the UNOTI first investigated the impacts of the PCE on shipping services and coastal port infrastructure along both the east and west coasts of North, Central, and South America, as well as the Gulf ports. A detailed spreadsheet of port specific actions and expenditures made in anticipation of the expansion of the Panama Canal is included as an Appendix. Impacts on selected ports and commodities, both imports and exports, were also assessed based on historic performance and informed speculation to the year 2020. Secondly, UNOTI assessed the impact of new shipping services calling on Gulf ports. The researchers investigated both import and export commodities shipped by container and determined which commodities can grow in Louisiana ports and/or what measures must be taken in order for this growth to occur. A select Project Advisory Board, representing a broad cross section of transportation leaders in Louisiana, in both the public and private sector, was convened to review the findings of this research project.

SCOPE

The original focus of this research project was the containerized shipment of bulk and break bulk products to and from the Gulf Coast. Geographically, the research focused on the Gulf Coast, Louisiana, and the LMR. New Orleans, being the predominant container port in Louisiana, receives particular emphasis as do other important Gulf Coast container ports including Houston and Mobile. Due to the highly competitive nature and broad geographic scale of container shipping, a critical component of the research project was to develop a comprehensive understanding of container ports in the United States, Canada, Mexico, and Central and South America.

Containers are often used nationally to move commodities such as agricultural or energy products traditionally transported in a dry bulk carrier or a tanker. This research examines the potential to increase the shipment of these products and others (fracking sand) in unitized form in containers. Results from the research effort demonstrate that there is currently little traffic in containers for bulk and break-bulk shipping along the LMR. However, the Port of New Orleans recently announced that they “intend to handle 1.6M TEU when all facilities are fully developed for containers [5].”

Looking forward, the largest potential change with regards to container shipping on the East and Gulf Coasts of the United States is the expansion of the Panama Canal that is expected to be finished in mid-2015. Due to the anticipated effects of the Panama Canal expansion on container shipping and the efforts of ports to expand and modernize their container shipping facilities, the researchers use the expansion project as the basis for analyzing future change in the use of containers for bulk and break-bulk shipping.

UNOTI realized late in the project that the recent emergence of LNG as a fuel and feedstock for industrial facilities will have a profound impact on Louisiana. The team focused on two aspects of LNG: as an export commodity using terminals being built in the Lake Charles region and as a feedstock for industrial plant expansions or new builds within the Chemical Corridor along the LMR between Baton Rouge and New Orleans. The latter will have implications for containerized shipments of plastic resins and other chemical products, currently being packaged and containerized at Transportation Consultants Inc. and the Kearney Companies. Both of these companies are located adjacent to the Inner Harbor Navigation Canal at the Port of New Orleans.

On November 27, 2013, a major coffee importer and roaster, S3 Pacorini Logistics, who operates Silocaf at the Port of New Orleans, announced their intent to import fracking sand in containers. This is the newest containerized cargo for the Port of New Orleans [6].

METHODOLOGY

Literature Review

This research effort began with a comprehensive review of literature and the collection and analysis of articles pertaining to this project which remains on-going. The initial review focused on academic articles and professional reports related to bulk and break-bulk shipping, container shipping, and maritime trade along the U.S. Gulf Coast. These studies provided a foundation of knowledge for the study. Additionally, the research team also relied on knowledge and experiences gained in studies that members had previously conducted, such as the *New Orleans Metropolitan Inland Waterway Container Transport Feasibility Study* for the Gulf Coast Research Center for Evacuation and Transportation Resiliency. Developments in international trade affecting Louisiana and the Gulf Coast Region occur on an almost-daily basis. An essential component of the literature review was the collection and review of articles published in trade journals, newspapers, and industry publications. Major news involving the shipment of bulk and break-bulk products happened throughout the research process. Louisiana is currently experiencing substantial investment in facilities to export bulk commodities such as LNG, coal, and grain. The research team monitored and continues to monitor news sources to collect and aggregate this type of investment information.

Trade Data Analysis

The collection and quantitative analysis of trade data and statistics supplemented the qualitative examination of literature. Trade, shipping, transportation, economic, and commodity data were obtained from multiple sources including the U.S. Census, USA Trade, Port Import/Export Reporting Service (PIERS), U.S. Department of Energy, U.S. Department of Commerce, industry publications, and port authority reports. The broad-ranging variety of products that constitute bulk and break-bulk products mandated the collection, integration, and analysis of data from myriad sources. Data analysis provided details of ongoing trends including the rapid expansion in U.S. LNG production as well as the export of coal from LMR terminals and mid-stream buoys. These methods offered insights and projections into the future of the probable growth in bulk commodity exports, especially agricultural and energy products.

Comparative Port Study

The comparative examination of United State port infrastructure, capacity, and expansion complemented the trade data analysis by providing context-specific information that could explain variations in trade statistics based on geographic location. The comparative port study resulted in a comprehensive database of North American ports that allowed an efficient and thorough analysis of current and future port conditions. A combined analysis of trade data with the comparative port study underscored the geographical importance of Louisiana as a gateway to and from the Mississippi River Valley. In the highly competitive industry of international shipping, strategic advantages that cannot be replicated by competitors are incredibly important. For the transportation of bulk and break-bulk products, the ability to barge these products down the Mississippi River directly to the Gulf or to ports in close proximity along the LMR provides a tremendous advantage to Louisiana.

Interviews and Site Visits

Interviews with industry leaders and site visits to New Orleans based container packagers offered the research team the ability to examine in greater detail trends and findings that emerged from the literature review, trade analysis, and comparative port study. The research team's extensive network of contacts within the maritime and freight industries provided additional information about on-going trends both locally and regionally. Emerging findings from the research, such as the increased potential for the shipping of bulk and break-bulk products in "traditional" vessels rather than on container ships were reported and confirmed by industry experts, including members of the Project Advisory Committee. The research team also participated in several site visits including one to Transportation Consultants, Incorporated in New Orleans, who package PVC resin for international export in containers. The research project also benefited from UNOTI's Research Associate Marc Howlett's week-long site visit to the Panama Canal in July 2013 as a member of a The Worldwide Association for Waterborne Transportation Infrastructure Technical Visit team.

IMPACTS OF THE PCE: A SYNOPSIS

Massive port investments throughout the Americas are being made in anticipation of the opening of the Panama Canal Expansion (PCE). Consequently, UNOTI organized its initial research around the myriad of potential futures resulting from this major transportation enhancement. When the original canal opened in 1914, it was an international shipping “game changer.” The researchers feel the PCE will be equally significant, but exactly how is very difficult to forecast at this time. However, its impact will be felt in all segments of the shipping industry, not just the container trade. In a recent speech Federal Maritime Commission (FMC) Commissioner William P Doyle remarked “The expansion will enable a doubling in the tonnage of trade that can pass through the Canal. In terms of ship size, the canal’s expansion will allow for a 160 percent increase in the size of ships able to transit the Panama Canal [7].” The canal widening will also greatly increase the tonnage of cargo carried by traditional bulk and break bulk carriers. It will be able to accommodate 120,000 dead weight tons (dwt) vessels versus the current tonnage limitation of 85,000 dwt for a dry bulk carrier. The defining characteristics for post-Panamax vessels are the required draft of the navigation channel (15.2 meters preferred), a beam dimension no greater than 49 meters, a length not to exceed 366 meters, and an air draft of 57.91 meters.

An Unexpected Synergy: LNG and the PCE

Liquid tankers will be equally impacted, especially those designed to transport Liquefied Natural Gas (LNG), a transformative product for the Gulf Coast, the U.S , and the world’s energy market. Again, FMC Commissioner Doyle noted “Once the Panama Canal opens, the distance to ship U.S. natural gas from the Gulf Coast of the United States to Asia will decrease by 9,000 miles. Only 21 of the existing global fleet of LNG carriers can currently fit through the Panama Canal. None are currently using the Canal. However, more than 80 percent of the tankers will be able to make the passage through the Canal once the widening is complete [8].”

Also tied to the LNG phenomenon is the multi-billion dollar investment in industrial development throughout the state and the construction and licensure of LNG export terminals along the Louisiana coast. The first approved LNG export terminal for sales to non-FTA countries is owned by Cheniere Energy and is being built along the Sabine Pass near Lake Charles. The importance of traditional bulk commodities carried in larger vessels, the rapid growth in industrial capacity of the chemical industry along the LMR due to LNG, and the emergence of LNG as an export commodity are the most significant findings for the state and

its economy. Bulk and break bulk commodities shipped in containers within LA turned out to be an incidental issue at the conclusion of this project, although it was the focus of this initial investigation.

Bulk and Break Bulk Commodities

To fully understand the dynamics of the bulk and break bulk trades within LA and in the greater Mississippi Valley, the researchers conducted an extensive literature review of recent reports issued by both the public and private sectors. These focused on the PCE's impact on the container trade and agricultural exports, related articles on the thermal coal trade, and the phenomenon of LNG as both an industrial feedstock and as a fuel. This in turn led the researchers to quantify the unprecedented investments being made in LA by industry (both domestic and international) in large part driven by LNG (see Table 3).

Table 3
Recent LNG driven industrial investments (expansions or new-builds) in Louisiana
 (Source: LED / Daily Journal Articles)

Project	Owner	\$B	Capacity	Details
Sabine Pass LNG Liquefaction Terminal	Cheniere Energy	0.15	2Bcf/d	1st LNG Export Terminal Approved for non-FTA countries
LNG Liquefaction Production / Export Terminal at Port of Lake Charles	Magnolia LNG	2.2	4mtpa	mid-scale LNG facility on 90 acre site
2 Gas to Gasoline Facilities	Sasol (South Africa)	21		largest manufacturing investment in LA's history
Gas to Gasoline Facility at the Port of Lake Charles	G2X Energy	1.3		LNG to Methanol to Gasoline Process
2 relocated Methanol Plants	Methanex (Canada)	1.1	1mtpy	Being reconstructed in Geismar and Gonzales
Phase 1 Hot-Rolling Tube Mill and Phase 2 Steel Mill @ Port of Caddo-Bossier	Benteler Group (Austria)	0.9		Near the Red River
Manufacturing plant for cryogenic tanks for LNG ship propulsion	NASA / Lockheed Martin	0.03		Defense production shifts to commercial applications
Plastics storage, custom packaging and distribution facility for petrochemical products	Katoen Natie USA (Belgium)	0.15		Adjacent to ExxonMobil Plant in Baton Rouge
5 Phase Iron and Steel Manufacturing Facility (2 Direct Reduced Iron Facilities; A Pellet Plant; a Blast Furnace w/ Coke Ovens; New Steel Mill)	Nucor	3.4		St. James Parish Site
South Louisiana Methanol LP	Todd and Zeep	1.3		Largest Methanol Plant in U.S.
Port Fourchon LNG Fueling Station / New LNG Fleet	Harvey Gulf	.4		First LNG marine fuel station
Chlor-Alkali Plant @ Geismar vinyls manufacturing complex	Westlake Chemical	0.46		Facility Expansion at Current Site

3M barrel tank storage expansion	NuStar Energy	0.36		Tank Storage Expansion in St. James Parish
New refinery for synthetic fuels made from animal by-products	Dynamic Fuels LLC	0.13		Summer grade to arctic grade and hi-performance jet fuels
Gulf Gateway Terminal @ Port of New Orleans	Murex Ltd. / Bulk Resources	0.03	10Kbph	New crude oil terminal at the Port of New Orleans
Cornerstone Fortier Facility	Cornerstone Chemical Co.	0.8		Feasibility study underway
2 new polyolefin plants / capital upgrades to increase capacity of ethylene production	Dow Chemical	1.06		Restarted an ethane cracker in Hahnville, LA
New Formic Acid Plant in Geismar, LA	BASF (Germany)	0.3	50K tpy	New Facility at BASF's Ascension Parish Plant
New Chemical Plant to produce specialty water-soluble polymers	SNF Flopam (France)	0.35		New Facility on 800 acre site in Iberville Parish, LA
Export Terminal at the Port of Greater Baton Rouge	Drax (Britain)	0.3		New wood pellet plants in LA and MS
New advanced, open ended cotton spinning facility	Zagis (Mexico)	0.07		New Plant in Jefferson Davis Parish
Constructing first commercial bio-fuels plant in United States	Sundrop Fuels	0.45	3.5Kbpd	Near Alexandria, LA
New Ammonia, Urea and Urea Nitrate Plant	CF Industries	2.1		Donaldsonville, LA
New Grain Export Terminal at Port of Lake Charles	IFG Port Holdings	0.06		Will handle rice, wheat, corn, soybean and dried distillers grain
South Louisiana Freight Rail Upgrades	Union Pacific Railroad	0.2		
New LNG Liquefaction export facility in Hackberry, LA	Sempra Energy	6	1.7Bcfd	
New Rare Earth Elements Separation Plant and Refinery in Geismar, LA	Avalon Rare Metals	0.3		Will refine 10 Canadian Rare Earth Elements
Equipment Modernization and New Blending Center for Synthetic Aviation Fuel	ExxonMobil	0.21		Upgrades at the Baton Rouge Chemical Plant and Port Allen Lubricants Plant
Port Hudson Terminal Modernization	Genesis Energy	0.125		Project includes an 18 mile crude oil pipeline extension to the Mobile Exxon BR Refinery & a new crude oil train facility
New Hydroxyethyl Cellulose plant	SE Tylose	0.12	9ktpy	Addition to Plaquemine, LA facility
Expansion of an existing chemical facility at Geismar, LA to increase output of methylene dihenyl isocyanate	Huntsman Corporation	0.078		A key component in polyurethanes
Bogalusa Paper Mill Modernization	International Paper	0.04		New Equipment and Technologies
New HQ and Manufacturing Facility	K & B Machine	0.04		
Increased Production Capacity of Polyvinyl Chloride (PVC)	Shintech	0.5		Increase Production 10%
New Fertilizer Plant using natural gas as a feedstock	EuroChem (Russia)	1.5		2 sites along the LMR under consideration

New Methanol Plant at existing St. Charles Parish site	Valero	0.6		Capacity to produce 1.6M tons of methanol per year
New Coal Terminal in Plaquemines Parish	RAM LLC	.024		Transfer coal from barge or rail cars, store and blend the product on site, then to oceangoing vessels.
Total Investment as of Dec. 15, 2013		48.9		

Specific US cargoes, both imports and exports, can be better predicted, particularly agricultural products and energy commodities responding to global markets in Asia that will be expedited by the PCE. The Indian Ambassador to the U.S., Nirupama Rao, recently commented that “the demand supply gap of natural gas in India, which is estimated at around 2.2 trillion cubic feet (tcf) per annum at present, was likely to go up to nearly 4 tcf per annum by 2016-17 [9].” Similar growth projections occur throughout Asia as well. This creates a natural market for LNG exports from the U.S. using the PCE for cheaper and more efficient transport. For example, an LNG carrier originating at a Lake Charles terminal and destined for Japan will save approximately 6,000 miles and 13 days in transit.

In a 2011 report *Panama Canal Expansion: Impact on U.S. Agriculture*, Informa Economics, Inc. forecasts that grain and soybean exports are to increase more than one billion bushels or 25 percent from 2011/12 to 5,277 million in 2020/21. Exports through the Central Gulf are expected to increase 726 million bushels or 39 percent to 2,576 million. The PCE will also extend the grain origination draw area to 152 miles from the Mississippi River [10]. It may also “provide a significant competitive advantage for U.S. Gulf and South Atlantic ports and for U.S. inland waterways – if we are prepared,” according to the USACE Institute for Water Resources’ report *U.S. Port and Inland Waterways Modernization: Preparing for Post-Panamax Vessels*, released on June 20, 2012 [11]. Most recently, Rabobank forecast that the cost of shipping U.S. grain to Asia will be lowered by 12 percent due to the PCE [12].

As has been previously noted by John Hyatt, vice-president of the Irving Brown Company in New Orleans as well as vice-president of the Louisiana International Gulf Transfer Terminal, “stakeholders in the Mississippi Valley stand to gain from the PCE, principally in the bulk trades.” Hyatt further noted “IHS Global Insight predicts certain macroeconomic trends such as a 170 percent increase in U.S. per capita income and a 32 percent increase in population by 2042. All of these indicators point to a bright future for exports from LA waters [13].”

U.S. Ports

As widely reported in the media, academic papers, and consultant's reports over the past decade, the Panama Canal Expansion is expected to have significant impacts on selected container ports on the Gulf Coast and the U.S. East Coast as well as the trade lanes serving these coasts. There is general consensus that, as a result of the PCE, the typical container ship will increase in capacity to an average of 8,000 twenty-foot equivalent units (TEUs), an industry standard, from the current limit of 5,000 TEUs. In addition, it will allow for the transit of LNG carriers. "When the newly widened Panama Canal opens in 2015, it will handle an estimated 12 metric tons of liquefied natural gas annually, a cargo planners didn't even consider when starting the \$5.25 billion expansion in 2007 [14]." This is just one of a number of unexpected impacts of the PCE.

International Trade Lanes

Depending upon the author's perspective, the impact of the PCE ranges from "being a game changer" to having little or no impact. However, all agree that the significant dimensional changes of the expanded Panama Canal will allow bigger, deeper, and more cargo laden vessels to cross the isthmus of Panama, creating new trade lanes and markets for international trade. This paper reviews the anticipated impacts on the container trades as well as on traditional bulk / break bulk vessels and liquid carriers, including those transporting LNG from U.S. Gulf Coast terminals to markets in Japan, S. Korea and China via the PCE.

With regards to new trade lanes being created as a result of the PCE, there are currently too many unknown factors to accurately forecast where these will occur. They include: the future toll structure for the PCE (to be determined by mid-2014); alternatives to the PCE, including the Suez Canal, and a new canal being proposed for Nicaragua by a consortium of Chinese interests; the creation of a hub and spoke shipping system utilizing a transshipment port whose location has yet to be determined; the emergence of the Northern Sea Route as a viable shipping route due to climate change affecting the arctic waters; and, the potential for a 50 ft. navigational channel for the LMR downriver of Baton Rouge. As these indicate, today's maritime environment is in a state of flux and will remain so until at least 2016 – 2017.

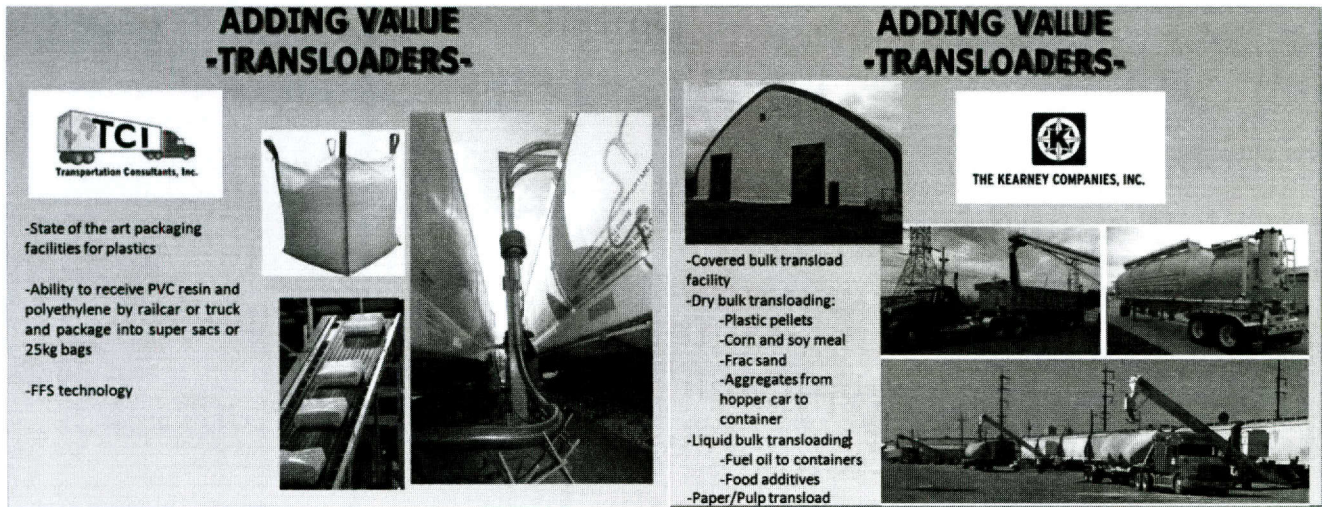
DISCUSSION OF RESULTS

Global Trade Dynamics for Containers Being Used for Traditional Bulk Cargoes and Their Impact on the LMR, the State of Louisiana, and Gulf Coast Ports

The single biggest impact to the container trade within the Gulf of Mexico will be the opening of the Panama Canal Expansion (PCE) in mid-2015. Various consultants, including IHS Global, Parsons Brinkerhoff, and A.T. Kearney, estimate that this project will result in 2.5M new import containers being transported into and through the Gulf either destined to ports along the Gulf Coast or the entire East Coast of the United States. Which ports will ultimately benefit from this new container trade is anybody's guess, but opinions vary widely on the PCE's impact. Proponents of west coast ports, principally Los Angeles / Long Beach, proclaim that there will be little or no effect to their container volumes, nor the land bridge to the U.S. midwest and east coast markets. Proponents of eastern ports, who are each spending enormous amounts of money to prepare for the post-Panamax world, project major shifts in international trade patterns. Maritime professionals and some academics, including Asaf Ashar, Ph. D., Faculty-Research at The National Ports and Waterways Initiative, a unit of UNOTI, feel there will be only modest impacts. Those who are right remain to be seen. But for the container trade (both import and export) originating or destined for Gulf Coast ports or ones located along the LMR, probably only Houston will see a significant increase in container volumes. The Port of Houston Authority is currently spending in excess of \$1.8 billion on support infrastructure in anticipation of this new trade activity.

Impact on the Port of New Orleans and Other Ports Along the LMR

For the Port of New Orleans, primarily a container export facility (72 percent exports in 2012), the impact from the PCE will probably be minimal, but the industrial expansions occurring along the LMR will be significant for the Port of New Orleans as well as the entire port system downriver of Baton Rouge. These industrial plant additions, or new builds, are primarily being driven by cheap LNG, either used as a fuel or as feed stock for various chemicals or fertilizers being produced in these new facilities. The transportation of plastic resins and other manufactured products currently being containerized in the greater New Orleans region will increase significantly as will the probable number of containers used for their transport. Transportation Consultants Inc., co-located on France Road Parkway immediately upriver of the Industrial Canal and at the Esplanade Wharf in New Orleans, is expanding their physical plant to accommodate 40,000 TEUs per year.



**Figure 5
Transloaders at the Port of New Orleans**

(Source: Port of New Orleans Asian PPP August 2012)

Other companies involved in the transloading of bulk commodities in containers at the Port of New Orleans include New Orleans Terminal LLC, Dupuy, and the Kearney Companies. Each will expand their operations based on future market conditions of specific commodities including PVC, polyethylene, plastic pellets, as well as corn and soy meal. At the Port of Greater Baton Rouge, Katoen Natie USA, an Antwerp, Belgium-based company, is investing \$150 million in a new plastics storage, custom packaging and distribution facility for producers of petrochemical products. This facility will use packaging technology similar to that being utilized by Transportation Consultants Inc. at the Port of New Orleans: a fully automated bagging/stuffing operation.

Coffee will remain a major import commodity for the Port of New Orleans. It arrives via container from Brazil, Columbia, Guatemala, West Africa, and Vietnam. Two major coffee processors are located within the Port of New Orleans: Silocaf of New Orleans and Folgers. In 2012, the Port of New Orleans handled almost 15,000 TEUs of coffee. New Orleans also has numerous specialty coffees that are roasted at plants throughout the region: PJ's Coffee and Tea Company, Community Coffee, etc. Other major commodities handled in containers by the Port of New Orleans include: vinyl alcohol; paper and paperboard including waste; wood pulp; synthetic rubber; synthetic resins; logs and lumber; pesticides; and fabrics including raw cotton, titanium dioxide, cadmium pigment, and zinc oxide.

TOP COMMODITIES- IMPORTS



IRON & STEEL- 1.9 million tons in 2012

- Up 38% over 2011, particularly oil field equipment (657% increase)
- Wire rods, pipes and tubes and bars all increased by 50% or more
- Top origins: China, Japan, Korea, Taiwan, Turkey



NON-FERROUS METALS- 620,125 tons in 2012

- Zinc, Copper and Aluminum
- NOLA is the second largest London Metal Exchange site in the US, behind Detroit
- Top origins: South America



NATURAL RUBBER- 345,000 tons in 2012

- NOLA is the largest port for imported natural rubber
- Moves inland via rail and truck to tire manufacturing facilities
- Top origins: Indonesia, Thailand, Malaysia, Guatemala



COFFEE- 226,200 tons in 2012

- 2 processing facilities and 6 roasters, all within a 20 mile radius
- Folgers has recently invested \$70 million in New Orleans to make NOLA its hub
- Top origins: Brazil, Columbia, Guatemala, West Africa, Vitenam



FOREST PRODUCTS- 125,000 tons in 2012

- Mostly veneers and plywood
- Top origins: China, Indonesia, Malaysia

TOP COMMODITIES-EXPORTS



CHEMICALS- 1.8 million tons handled in 2012

- Shale gas revolution and cheap natural gas fueling massive expansion in chemical production in Louisiana
- Shintech and Dow are expanding production and new plant construction from Sasol, Shintech, Huntsman, CF Industries, SE Tylose (sister company of Shintech),Methanex just to name a FEW
- TCI, The Kearney Companies and Dupuy provide transloading



PAPER AND PULP- 380,500 tons handled in 2012

- The Kearney Companies provides transloading from railcar to container
- Excellent rail connectivity to paper mills



FROZEN POULTRY AND OTHER ANIMAL AND VEG PRODUCTS-

500,000 tons handled in 2012

- State of the art blast freeze cold storage facility located adjacent to Napoleon Avenue Container Terminal, facility is rail served
- Additional cold storage facilities on the industrial canal

Figure 6
Top commodities: imports and exports

(Source: Port of New Orleans)

Interestingly, according to Port of New Orleans CEO Gary Lagrange, the port's number one container commodity is "air"; i.e., empties account for roughly 33 percent of the annual container count at the Napoleon Avenue Container Terminal, far exceeding any other containerized cargo.

Currently the Port of New Orleans and the other ports within the LMR Corridor (Baton Rouge downriver to the Head of Passes) represent the world’s largest port complex by tonnage. Ports and private terminals serve as major nodes for both imports and exports of bulk commodities as well as containers. Louisiana import commodities are heavily dominated by crude oil from Saudi Arabia, Venezuela and Kuwait. The value of these imports has recently increased dramatically.

Exports, having more than tripled from 2005 (\$19.4 billion) to 2012 (\$62.9 billion), are dominated by agricultural products followed by petroleum and coal products, chemicals and food manufacturers. These export commodities are primarily destined for China, Mexico, Japan, the Netherlands, as well as Canada, Brazil, and Singapore. The Asian market, representing 31 percent of the total export market, is the primary driver of Louisiana export growth with a net increase of \$13.8 billion between 2005 and 2012. Agricultural products dominate the Asian trade comprising 63.8 percent of all exports to Asia by value. The transportation costs of these commodities will greatly benefit from the dimensional and weight increases resulting from the PCE and the vastly increased number of vessels that will be able to use the widened canal.

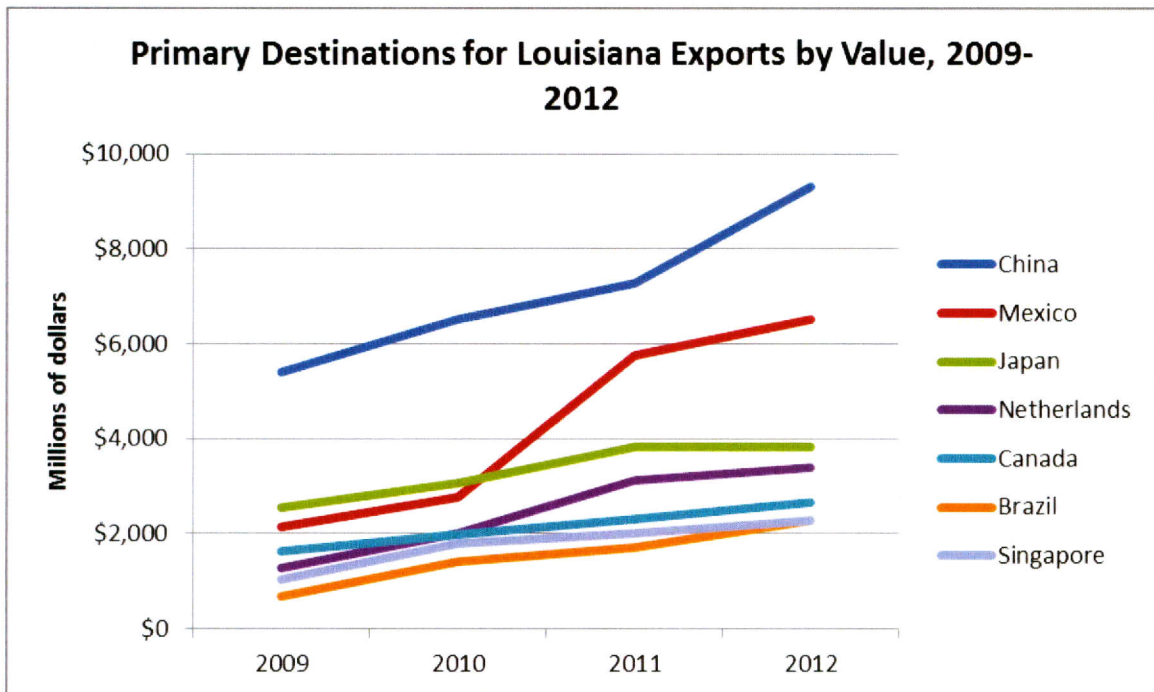


Figure 7
Primary destination for Louisiana exports by value, 2009-2012

(Source: U.S. Census Bureau International Trade Data)

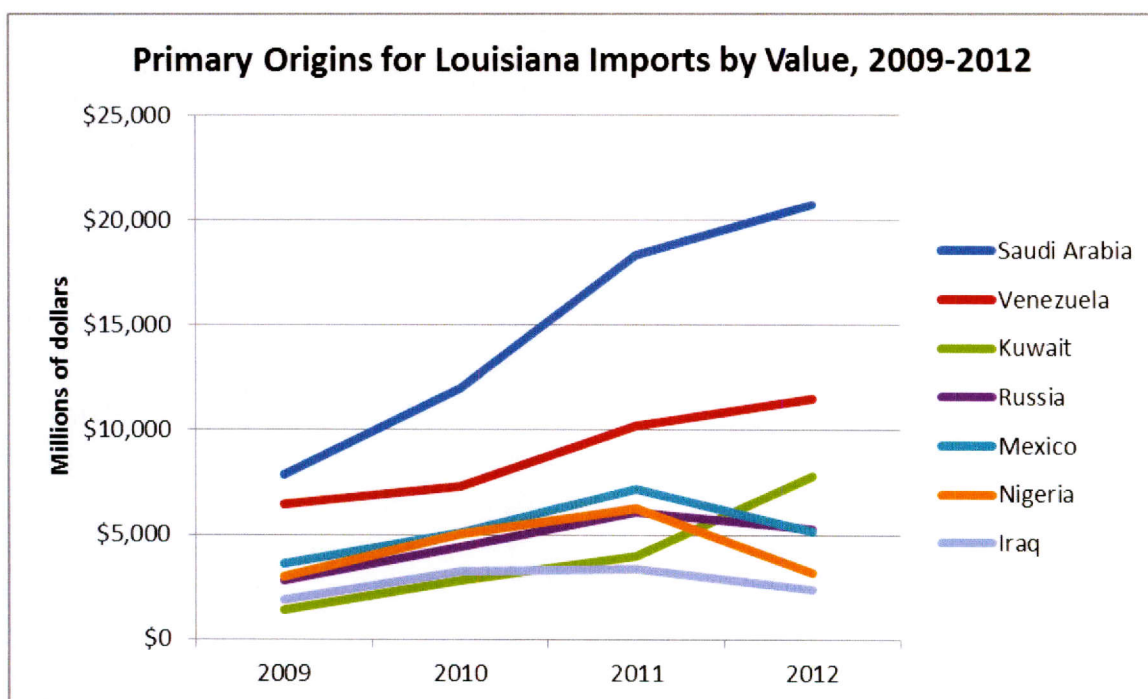


Figure 8
Primary origins for Louisiana imports by value, 2009-2012

(Source: U.S. Census Bureau International Trade Data)

The data clearly shows the impact of imported crude from oil producing nations including Saudi Arabia, Venezuela, Kuwait, Russia, Nigeria, and Iraq on the state's economy. Mexico is also a major contributor of imports to Louisiana.

On the export side of Louisiana's trade activity, as was previously noted, China, Japan, and Singapore will all benefit from the PCE and its impact on the transportation costs of export commodities, in particular agricultural grains and soybeans, thermal coal, and LNG.

The Impact on International Trade

Opinions on the impact of the Panama Canal Expansion on international trade vary widely among port officials, shipping company executives, and academics as well as journalists covering shipping and international trade. Some believe that the net impact will be negligible. This view is held by officials with West Coast ports, who think shippers have already made up their minds and will continue using their ports and connecting inland land bridges to access the US market. Others feel the PCE is a game-changer. This opinion is held by port officials from East Coast and certain Gulf Coast ports. The future will only be

determined once the Expansion is open and operational in mid-2015.

As noted in a recent Journal of Commerce Maritime News Summary entitled Panama Canal Expansion, “the \$5.25 billion expansion ... will either dramatically boost East and Gulf Coast container trade or disappoint their expectations of gaining more cargo. But the opening of much larger locks in 2015 is already boosting prospects for more exports to Asia from U.S. Gulf ports of LNG, coal and grain cargos....What is certain is that the doubling of capacity on the connector of the Atlantic and Pacific oceans will change the way the world's shipping lines ply their global routes. The doubling of the canal's capacity will allow shippers to bring their Asian goods to the Eastern and Gulf coasts for less money. That's largely because the new locks will be able to handle larger vessels that can carry nearly three times as many containers. The project is also expected to bolster Panama's strategic positions as a transshipment hub and spoke business center for much of Central and South America [15].”

In September 2013, Rodolfo Sabonge, the canal authority's Executive Vice President of market analysis and research, noted that the opening of the PCE will allow the canal to recapture much of the U.S. East Coast container trade that is currently being diverted to the Suez Canal route. Further, he believes that the biggest growth will be in dry and liquid bulk cargoes and transshipment container cargo moving in the north-south trades [16]. The use of the Suez Canal has recently been questioned as ships moving through the desert have come under fire by terrorists using rocket-propelled grenades (RPGs). If these attacks continue, the Suez Canal as a viable option will be diminished.

What is generally agreed upon in the maritime community is “the size of the ships that will be deployed on the All-Water Asia US East Coast through Panama (AWP) services when the widened Canal opens, are anticipated to average around 8,000TEU similar to the size of ships presently deployed on All-Water Suez (AWS) services. There is also general agreement that despite the considerable increase in ship size and the respective reduction in shipping costs, the AWP route is likely to see only a modest increase in market share relative to its main rivals, the AWS and the US West Coast (USWC) land bridge [17].”

Media coverage, conference presentations, and research papers regarding the Panama Canal Expansion generally focus on consumer products being imported from East Asia by mega-container ships that will soon be able to transit the new locks to access Gulf Coast and East Coast ports. But what if that is not the story for Louisiana or the majority of Gulf Coast ports? For Louisiana, in particular, the primary impact of the Panama Canal Expansion will be in the exportation of energy (petroleum, LNG, and thermal coal) and agricultural products to East Asia on bulk carriers and tankers. Many involved in the container trade at the PONO

see no impact whatsoever from the PCE. There will not be a significant growth in the container trade along the LMR (LMR), especially if the current draft restrictions of the navigational channel remain (45 ft.).

However, a major game-changer for ports and terminals located along the LMR was announced on August 22, 2013 by Sean Duffy, Executive Director of the Big River Coalition (BRC). He released a report co-sponsored by DOTD and BRC by Dr. Ryan entitled *The Economic Impact of Deepening the Mississippi River to 50 Feet*. According to Dr. Ryan, for every dollar spent to deepen the river below Baton Rouge to 50 ft., \$89.40 will accrue in benefits. “Port and shipping officials are pushing for the project to accommodate the post-Panamax ships that are expected to emerge in the coming years with the expansion of the Panama Canal [18].” The deepening will initially cost \$300 million and require \$90 million in annual maintenance. Whether this project is politically doable is a matter of pure conjecture at this time, but at least it has been thoroughly investigated by a reputable local economist familiar with the Mississippi River, the maritime industry, and the state of Louisiana.

Regardless of the outcome of this deepening project, according to Global Insight, a leading maritime trade consultancy, container trade volumes worldwide will double by 2020. In a recent report by the US Corps of Engineers *US Ports and Inland Waterways Modernization: Preparing for Post-Panamax Vessels* as previously cited, the Corps estimates that by 2030, post-Panamax vessels will comprise approximately 62 percent of the total container ship capacity. These predictions clearly point to the ever growing importance of the container trade to the world’s economy. Whether this growth will be significant for Louisiana or for the LMR ports remains to be seen. There are currently too many unknowns to forecast an accurate future for international trade or trade lanes. However at several ports along the Gulf Coast, preparations are being made for the consequences of the PCE.

RESPONSES TO THE PCE

The Port of Houston Authority

The container trade along the Gulf Coast is dominated by the Port of Houston and to a lesser degree by the Ports of Mobile and New Orleans. All of these Gulf Coast ports continue to show growth in container volumes. However, by mid-2015, coinciding with the completion of the PCE, Houston will be the only Gulf Coast port ready to accept post-Panamax ships.

Houston has inherent strengths which continue to grow: its 2012 population was 6.18 million (rank #5 in US); it serves as the Gulf's preeminent petrochemical/energy center; and, 70 percent of its cargo is consumed by the greater Houston market. The Port of Houston Authority also has strong transportation linkages to all modes. Taking into account all these factors, Houston's port is a prime location for the maritime industry in a post-Panamax world.



Figure 9
Barbours Cut Container Terminal

(Source: Port of Houston Authority 2013)

Houston continues to be the largest Gulf Coast container port, handling 67 percent of the Gulf's container traffic in 2012. The Port of Houston Authority also has an aggressive capital investment program underway: a project to deepen and widen the Houston Ship Channel; dredging the main waterways to 45 ft.; improving facilities and other physical assets; installing new on-dock cranes at both the Barbours Cut and the Bayport Container Terminals. To maximize the potential of the post-Panamax world, Houston's Port Authority is spending over a 10-year period \$1.83 billion in capital improvements. In 2011, container volume totaled 1.4 million TEUs or 16.9 million tons. Exports totaled 873,100 TEUs.

Imports totaled 570,500 TEUs. Export cargoes included 35 percent resins and plastics; 14 percent chemicals and minerals; 10 percent food and drink; and 10 percent machinery, appliances, and electronics. Other export commodities were automotive products, fabrics and raw cotton, apparel and accessories, steel and metals, retail consumer goods, hardware and construction materials, furniture, etc. Import container cargoes included food and drink (10%) and miscellaneous (15%). Other import cargoes were similar to those that were exported.

The Port of New Orleans

The Port of New Orleans (PONO) is at the center of the world's largest port complex measured by tonnage stretching from the Port of Greater Baton Rouge down the LMR to the Head of Passes. PONO is also the only US port connected to all six Class 1 railroads and is directly connected to over 33,000 miles of inland waterways. The PONO handled 463,147 TEUs in 2012, just behind their best year's total (2011 = 477,363 TEUs). They have been upgrading facilities at their Napoleon Avenue Container Terminal since it opened on November 1, 2003. During the last decade, a variety of upgrades have been completed including new on-dock rail service, improvements to the wharf shed, reconfiguring the adjacent rail yard to accommodate more container storage, as well as the acquisition and installation of two 110-ft. cranes to assist in the transfer of containers. The port has a total of 6 gantry cranes operating today. Gary Lagrange, President and CEO of the Port of New Orleans, foresees the need for an additional \$478 million to complete the Napoleon Avenue Container Terminal's build out which would allow for 1.6 million TEUs per year, allowing the port to grow their container business by 7 percent annually from 2015 – 2025.



Figure 10
Napoleon Avenue Container Terminal Expansion

(Source: Port of New Orleans)

The Port of Mobile

Since 2005, the Alabama State Port Authority, located on Mobile Bay, has spent \$700M to prepare for new opportunities in the post-Panamax world. Their 2012 container volume was 219,000 TEUs. They have dredged their access channel to 45 ft., acquired two post-Panamax cranes, developed a new turning basin (able to accommodate 1200-ft. vessels) and built new warehouses and terminals. Officials are now proceeding with improvements to the Garrows Bend Intermodal Transfer Facility and are proceeding with ship channel widening as well as access channel dredging (ultimately 55 ft. costing \$1 billion). They are working on several rail projects: \$148 million invested in intermodal rail projects and their container terminal Phase 2. They are also pursuing a direct freight rail link to Birmingham, Alabama.



Figure 11
Alabama Port of Mobile container terminal

(Alabama State Port Authority)

The Impact of the PCE on the Container Trade at Gulf Coast and East Coast Ports

Several expert consultant companies (Parsons Brinkerhoff, A.T. Kearney, Booz Allen) estimate that the annual container volume entering the Gulf will increase by 2.5 million once the Panama Canal Expansion is open and functioning (Spring-Summer 2015). These are containers that would have entered the US by the West Coast ports, from Lázaro Cárdenas, Michoacán in Mexico or Prince Rupert, B.C. in Canada. However, where the mega container ships, which require an optimum 50 ft. depth, will ultimately call along the Gulf or East coasts remains to be seen. According to retiring Administrator of the Panama Canal Authority, Alberto Alemain, probably only two East Coast ports and one Gulf Coast port will be chosen as final destinations by the mega-ships.

However, multiple ports along both the East Coast and the Gulf of Mexico are spending billions of dollars to accommodate these vessels: eliminating air draft restrictions at the Bayonne Bridge in New York; channel deepening to varying depths at Charleston (50 ft.), Savannah (47 ft.) and Houston (45 ft.). At the Port of Miami a new tunnel is being built to

resolve freight bottlenecks, new rail connections are under construction, cranes are being updated, and their access channel is being dredged to 50'. The total cost for these improvements at the Port of Miami are \$2 billion. Florida's Governor Scott predicts that the introduction of post-Panamax ships into the Gulf of Mexico and the dredging of their navigational channel will result in major shifts in international trade routes, and "will create 30,000 new jobs and increase the Port of Miami's annual economic impact to more than \$34 billion [19]."

Projects at the Port of NY/NJ, the Port of Charleston, the Port of Savannah, the Port of Jacksonville, and the Port of Miami were recently included in President Obama's "We Can't Wait" initiative which seeks to expedite the review and permitting of their respective post-Panamax projects.

The envisioned impacts may happen, but at this time, a number of variables still remain unresolved which make their probability uncertain: toll rates for the new canal have not been established; alternative canals may affect the Canal's market for ships (Suez and a recently announced Inter-Oceanic Nicaraguan Canal); a proposed new railroad across Honduras; the state of the worldwide economic recovery; role/location of transshipment hub in reestablishing world trade patterns; and, the emergence of the Northern Sea Route along the Arctic Coast. Given these unresolved issues, it is impossible to chart a clear future for international trade within the Gulf Coast or along the East Coast. However, some impacts can be reasonably predicted relative to specific cargoes.

U.S. Agricultural Exports from the Gulf of Mexico via LMR

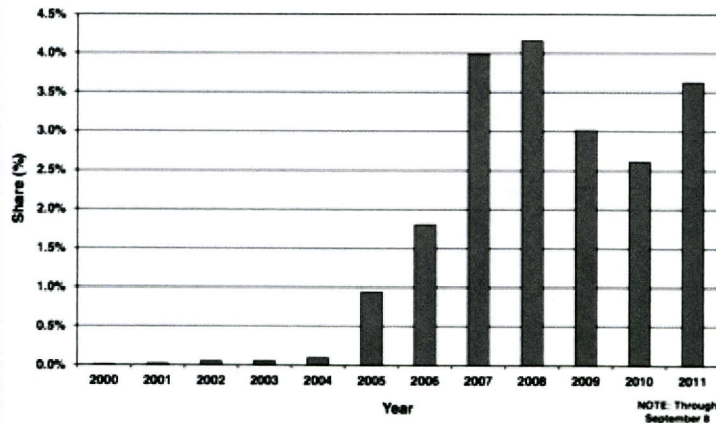
According to LSU AG economist Kurt Guidry, "according to USDA figures, LA had \$1.6 billion worth of agricultural exports in 2012 (LA grown). Sugar was the top export product from LA, at \$304 million in 2011. Rice was second at \$264 million, followed by cotton at \$242 million. LA's proximity to the Gulf and the Mississippi River make it an ideal export terminus. The Mississippi River and the ports have a big impact in terms of moving grain into the world market [20]." A new tenant at the Port of Greater Baton Rouge, Louis Dreyfus Commodities, is making a \$100M improvement to their grain-loading facility. The end result should be increased amounts of grain loaded onto barges and ships transiting the LMR. Other port facilities also have a role in LA's exports. The Port of Lake Charles exports large amounts of rice [20].

Jerry Hingle, CEO and President of The Southern United States Trade Association, noted in a recent article that "America's agricultural sector has been a bright spot in the U.S. economy,

with exports rising more than 50 percent in the past five years. It's one of the few sectors of our economy enjoying a strong trade surplus. The US exported a record \$141 billion last year, and global demand will continue to rise sharply, particularly among growing middle classes that recognize our products for their quality and safety. \$25 billion in food and agricultural commodities were shipped out of LA ports in 2012. LA is a large part of that export success with high value food and agricultural exports currently valued at \$426 million, an increase of 43 percent in the last 5 years and intermediate exports such as soybean oil having increased 74 percent since 2007. Because of a rising world population and an increasing ability to afford higher quality foods, global food and agricultural demand is expected to double by the year 2050 [21]."

Currently, the Panama Canal handles three out of every ten bushels of grains and soybeans exported from the U.S. More than half of exports from the Center Gulf transit the canal. This compares to one-tenth of exports from the Texas Gulf and nearly 30 percent from the Atlantic Coast ports, according to analysis by Informa Economics. For soybean exports, the canal is even more important. It handles 44 percent of total exports of the commodity, 63 percent shipped from the Center Gulf, 57 percent through the Texas Gulf, and more than half the volume through the Atlantic Coast [22]. However, not all agree to this assessment. According to Peter Malpas, global research director of Braemer Seascope, "most bulk trades have no reason to use the canal. I can see some coal and grains from the U.S. Gulf using the Canal's new locks, depending on the tolls, but not that much more [23]." In the future, greater volumes of U.S. grains could also be shipped in containers, whether via the Panama Canal or by using alternative routes.

Share of U.S. Grain and Soybean Exports by Container, 2000-2011



Source: Informa Economics, 2011

Figure 12
Share of U.S. grain and soybean exports by container, 2000-2011

(Source: Informa Economics)

As the above shows, only a small number of containers are used for the transportation of grains or soybean exports in the U.S. In 2011, roughly 3.6 percent of grain and soybean exports (identity preserved soybeans destined for high-end tofu manufacturers in Asia) do use containers. Distillers' dry grain, a byproduct of ethanol production, is also an export commodity transported by container. However, there is little traffic in containerized agricultural exports in the LMR. Wheat exports typically use Pacific Northwest U.S. ports or those located in British Columbia.

Relative to the use of containers for agricultural exports (corn, identity preserved grains, dried distillers grain, wheat) within the U.S., a significant obstacle is the “match-back” of containers: i.e. inbound containers of consumables from Asia typically are bound for large metropolitan areas, but once emptied, in order to back ship agricultural commodities to Asia, the containers must be repositioned by truck or rail to grain export facilities located hundreds of miles from their inbound destination. According to one expert, Ed Zaninelli, Vice President of trans-Pacific Westbound at Orient Overseas Container Line, speaking at a recent Journal of Commerce (JOC) Inland Distribution Conference (September, 2013), “this situation is worst in North America.” However, “the Chicago area is one of the few inland container destinations where empties can be efficiently and consistently repositioned to grain

export facilities in the Midwest,” according to another JOC speaker, Bo DeLong, Vice President of grain operations at DeLong Co. “Ocean service to major markets in Asia is efficient, vessel space is abundant and shipping rates are favorable for exporters” noted Zaninelli. Also encouraging is “that importers in China and Southeast Asia are turning increasingly to container shipping for food products because it is a cleaner mode of transport than bulk vessels and grain products can be purchased in manageable quantities. Also, the transportation infrastructure in Asia is better suited to moving grain in containers than in bulk,” according to JOC writer Bill Mongelluzzo. However, if the railroads, the shipping lines, exporters, and importers all work together to solve the problem of match-back in remote locations, the amount of containerized shipments of agricultural commodities could greatly expand. Currently, they amount to less than 4 percent of the total export volume [24].

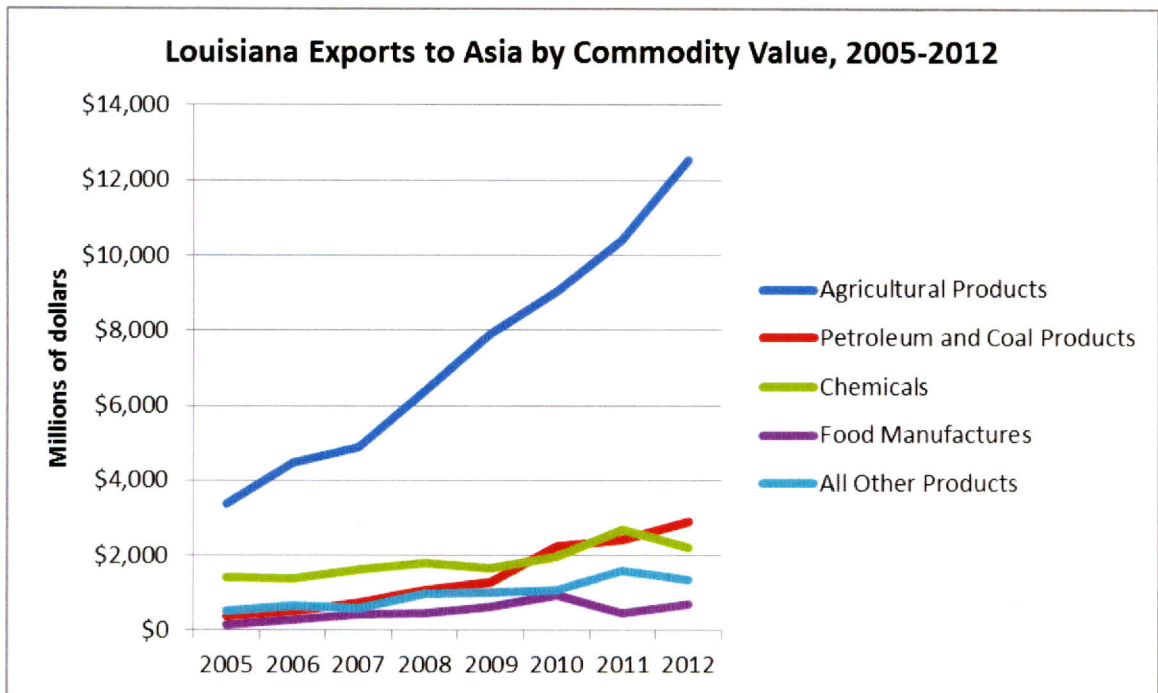


Figure 13
Louisiana exports to Asia by commodity value, 2005-2012

(Source: U.S. Census Bureau U.S. International Trade Data)

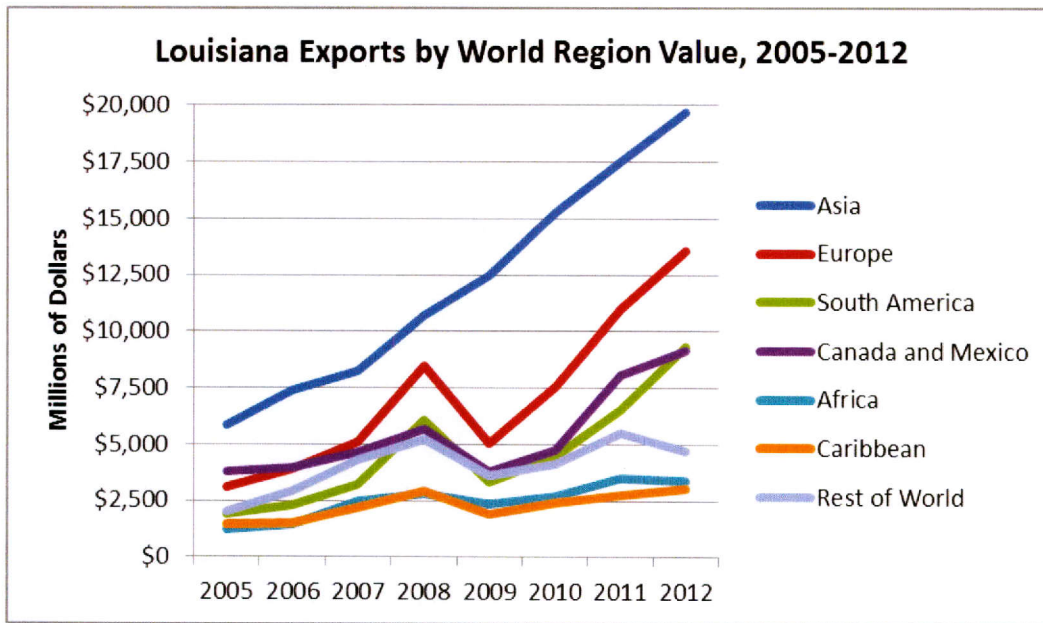


Figure 14
Louisiana exports by World Region Value, 2005-2012

(Source: U.S. Census Bureau U.S. International Trade Data)

As the above figures illustrate, both in terms of value and destination, Asia is the number 1 region in the world for Louisiana exports; Europe is number 2; South America is number 3. This is consistent with information obtained from the PONO.

Steam/Thermal Coal Exports

The steam / thermal coal trade increased by about 18 percent from 665 million tons in 2011 to 784 million tons in 2012, supported by high availability and low prices, according to the latest Drewry's *Dry Bulk Forecast*. The US is gaining increasing importance in the steam coal export market. Increased availability of cheap natural gas means there is more thermal coal to sell in the international market. In 2012, the US exported 47.4 million tons of thermal coal, up from 31.4 million tons in 2011 and 16.6 million tons in 2010.

The report shows that of all the bulk commodities in the dry bulk sector, steam coal has the brightest outlook. Steam coal trade is expected to keep rising, driven more by abundant supply than high demand. High availability of coal will keep prices low enough to ensure steep increases in imports. Moreover, freight rates are not expected to recover by much in the next few years, which will further cap Cost, Insurance, and Freight (CIF) prices, thereby supporting buying. Despite having a strong mandate favoring greener fuels, low prices have persuaded Europe to switch to coal [25].

According to a headline story in the June 14, 2013 edition of the *New York Times*, “Last year, American coal exports set a record of 125 million tons in sales, roughly double the volume in 2009, with most of that going to Europe. Exports fell this spring because of slower Chinese demand for steelmaking coal. But energy experts say the big potential market for American coal remains in Asia, and several proposed Pacific Northwest export terminals would have the capacity to nearly double current exports...The Powder River basin produces more than 500 million tons of coal a year, nearly half the country’s total, but only about 15 million tons are exported every year, mostly because of the lack of export outlets. Some of the basin’s coal can be shipped down the Mississippi River to ports on the Gulf of Mexico, but that mostly goes to the crowded European market [26].”

LNG as a Marine Fuel

Harvey Gulf International Marine’s LNG fueling station is now under construction, and their first 6 LNG-powered offshore supply vessels will be located at the Port of Fourchon at the tip of Louisiana at the Gulf of Mexico. This represents a \$400M investment in the future of LNG as a marine fuel. The New Orleans based company will install six 90,000-gallon tanks, which are vacuum sealed and encased in an outer shell similar to a Thermos. As reported in the *Tri-Parish Times* on September 25, 2013 Harvey Gulf, at Port Fourchon, will be the first U.S. port to offer LNG as a marine fuel and act as an operational nexus for Harvey Gulf’s emerging fleet of LNG powered offshore supply vessels [27].

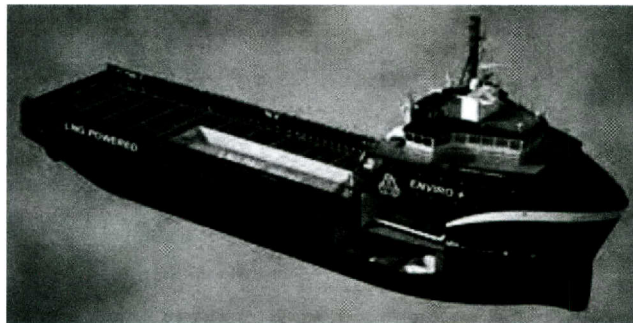


Figure 15
LNG powered offshore supply vessel

(Source: Harvey Gulf International Marine)

LNG Fuel Exports

Companies that transport LNG – with over \$20 billion being invested in facility construction centered in the Lake Charles area – may be among the biggest beneficiaries of the Panama Canal Expansion. Given their strategic location along LA’s Energy Coast, coupled with the area’s supportive infrastructure, these companies will be able to serve large Asian markets with significant cost savings due to the reduced trip distance (saving 6,000 miles in transit). However, the U.S. government must still decide which companies can export LNG to non-FTA countries. To date, Cheniere Energy’s Sabine Pass Liquefaction Terminal is the first LNG exporter approved to ship to high-margin companies (Japan, South Korea) that are not members of a free trade agreement.

Once the expansion is complete, the Panama Canal will accommodate about 90 percent of the world’s LNG fleet. Today, more than 130 ships transport millions of metric tons of LNG. According to Kevin Keenan, an attorney who specializes in LNG shipping for international law firm Baker Botts in Houston, “Either way, I believe there will be a tremendous demand for new-build LNG carriers over the next several years [28].”

As Federal Marine Commissioner William P. Doyle recently stated at a Panama Canal Forum at the Eno Center for Transportation in his keynote address:

“I would like to provide an example of a new type of U.S. manufactured export product that could really benefit from the expansion of the Panama Canal.

Not long ago the United States was positioning itself to be the world’s largest importer of natural gas. In 2006 there were approximately 50 proposed liquefied natural gas (LNG) import projects in some stage of regulatory review. The U.S. was on the verge of becoming ever more reliant on the Middle East for its natural gas.

That all changed in 2008 when the independent natural gas producers in the U.S. proved that abundant amounts of natural gas could be extracted and produced from shale basins in places like the Pennsylvania, Ohio and West Virginia. Indeed, these producers perfected the technique known as horizontal multistage hydraulic fracturing.

Today, the U.S. has not only slashed its imports of natural gas from overseas, but we are on the verge of becoming a major competitor on the supply-side of natural gas through our LNG exports.

The world's largest market for liquefied natural gas is Asia. As it stands now, South Korea and Japan are the largest importers of LNG. In the coming years, China may be added to that list.

With the Dominion Cove Point decision issued by the Department of Energy last Wednesday, the Obama administration has now authorized 6.37 billion cubic feet of liquefied natural gas to be sold overseas. Dominion, located in Maryland, is the first East Coast export project that has been approved and it is the closest terminal to Appalachia's Marcellus and Utica shale formations.

Previously, the Energy Department approved conditional export licenses to three Gulf Coast terminals: Lake Charles, Louisiana project, as well as the Freeport LNG project on Quintana Island, Texas, and, in 2011, Houston-based Cheniere Energy's Sabine Pass facility in southwest Louisiana [29].”

Obviously, for private sector terminal operators, LNG carriers, as well as individual parishes and the state of Louisiana, the export potential of LNG is huge. The only question remains which of the 24 pending licenses for non-FTA LNG export will be approved.

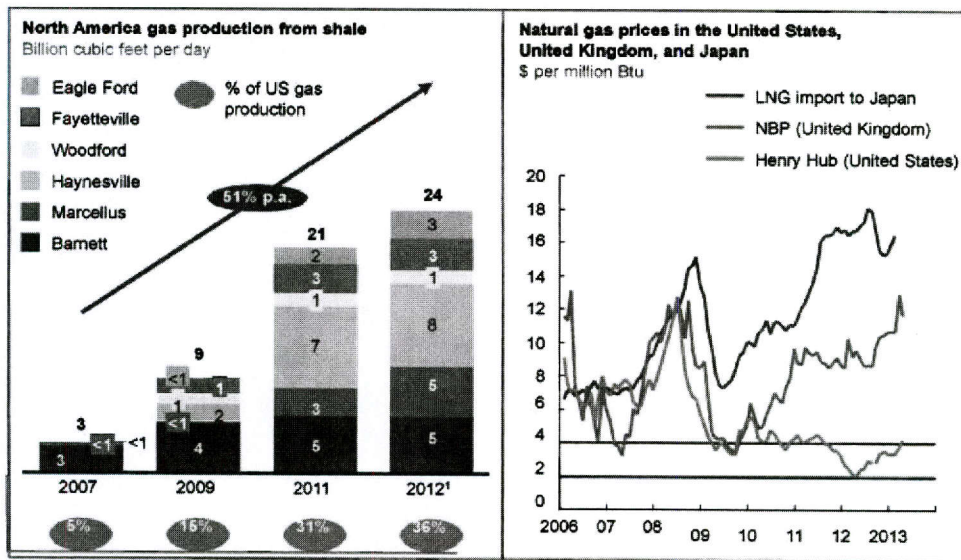
LNG Exports and the PCE

Perhaps the biggest single factor in the economic future of LA and the Western Gulf Coast is the emergence over the last six years of cheap liquefied natural gas (LNG) produced in the U.S. When the PCE was being designed, this market wasn't even on the radar, but today it is driving over \$60 billion in physical plant development and/or expansion in LA alone. This does not include similar expansions in Texas. At the time the expansion began, there was only a single LNG export terminal – Conoco-Phillips' 44 year old Kenai facility in Alaska. Since then, Cheniere Energy has obtained an export license for LNG to non-FTA countries and is currently constructing their Sabine Pass Liquefaction facility in LA as Rigzone staff reported in an article *US Gas and the Panama Canal Expansion: Serendipity on Display* published on May 16, 2013. According to John Hritcko, Houston-based director of LNG Sales for Wison Offshore and Marine, “Despite the lingering LNG export unknowns in North America, LNG shipments from the region coupled with the expansion of the Panama could exemplify serendipity on a grand scale. The Canal's expansion could also reduce overall LNG shipping costs by approximately 25 percent. Since the existing Canal excludes most of the LNG fleet, there has been no LNG market for the Canal. However, once the Expansion is complete US LNG exports could be a significant market for the PCA [30].”

LNG Driven Industrial Development

Another impact directly related to the abundance of cheap LNG in LA is the unprecedented amount of investment in industrial plant expansions or new builds along the LMR that are using LNG as a fuel or feedstock. This investment frenzy began in the late 2000s and has continued through today. It has been driven by both domestic and international companies. See the Appendix for a detailed summary of projects by company. The importance of these investments for the container trade is that today PVC resins constitute a significant volume of export cargo containerized at the PONO. With these new facilities producing various chemicals used in the manufacture of plastics, paints, lubricants, etc., container trade growth can be expected as evidenced by the expansion plans for TCI at the PONO and the investment being made by Katoen Natie USA at the Port of Greater Baton Rouge in packaging and storage facilities for plastic resins and associated products.

Shale gas production in North America has grown by 51 percent annually since 2007, lowering the price by two-thirds



1. Marketed production levels at wellhead. Includes lower 48 onshore and Gulf of Mexico offshore volumes.
NOTE: Numbers may not sum due to rounding.
SOURCE: Energy Insights (a McKinsey Solution); Hydrocarbon Production Data; US Energy Information Administration; McKinsey Global Institute Analysis

Figure 16
Shale gas production in North America, the United Kingdom, and Japan

(source: McKinsey Global Institute Analysis)

As previously shown, LNG has dramatically been reduced in cost in the US with the emergence of horizontal drilling and fracking technologies, primarily in the last few years. This in turn has led industries to announce in excess of \$48 billion in new-builds or expansions of their facilities along the LMR or in the Lake Charles region. (See Table 3)

Promising Future for LA Exports including LNG post PCE

In conclusion, for Louisiana ports and its maritime infrastructure, the greatest impact from the PCE will be the size of vessels that can transit through the widened canal; the growth of traditional bulk cargoes serving the Asian markets that use the Mississippi River as a transportation corridor; and LNG as a new export commodity. There won't be a significant growth of container volume along the LMR, in part, due to the draft restrictions of the existing navigational channel (45 ft.). The cost of transporting bulk cargoes (grains, soybeans, as well as plastics, chemicals, and LNG) will be reduced and their annual volumes will grow. Private industry will also benefit from the increased vessel size, particularly those plants (either existing or under development) that produce chemicals, resins, fertilizer or related products using LNG as a feedstock. Finally, 80 percent of the world's LNG tanker fleet will be able to transit the PCE. This is particularly important for the new LNG export terminals being constructed near Lake Charles, LA.

UNKNOWNNS AFFECTING THE POST-PANAMAX WORLD

PCE Tolls

The Panama Canal Authority is currently evaluating the transit tolls for a variety of vessels. Until this is finalized, scheduled for mid-2014, shippers will not make a firm decision on their international routing. In order to recover their \$5.25 billion investment, the PCA will increase their tolls. But questions remain: By how much? Will the rates be competitive?

Suez Canal

As an alternative to the Panama Canal, the Suez Canal has recently been chosen by Maersk Line, the world's largest container carrier, for its mega-ships serving the Asia to US shipping route rather than the Panama Canal. According to CEO Soeren Skou, Maersk will use the Suez Canal for vessels with a capacity of 9,000 TEU rather than sending two 4,500 TEU through the Panama Canal because "the economics are much better with the Suez Canal simply because you have half the number of ships." However, a recent terrorist attack on a container ship transiting the Suez Canal has caused the entire maritime industry to pause and consider the real security risk presented by this canal and the resultant costs associated with increased insurance requirements.

Nicaraguan Canal

In early June 2013, the government of Nicaragua signed a 50-year concession with a Chinese company to build a canal linking the Atlantic and Pacific oceans. This is a project that has been envisioned for the past two centuries but until now, no firm proposals have been made by any interested party. Backed by a Hong Kong telecommunications billionaire, with no prior history with large infrastructure projects, this \$40 billion project includes not only a canal but an oil pipeline, two deep-water ports, an interoceanic railroad, and two airports. Many in the maritime and financial markets are highly skeptical of this grandiose project, but Nicaragua sees it as a way to double the country's per capita GDP, currently at \$3,300, one of the hemisphere's lowest.

Honduran Landbridge

Almost simultaneously, on June 20, 2013, the government of Honduras announced plans to work with another Chinese Company to construct an Atlantic to Pacific railroad to boost trade across the Central American isthmus. They signed a Memorandum of Understanding soon after with China Harbour Engineering Company Ltd. to build a railway to link Interoceánico Amapala island in the Pacific with Puerto Castile on the Atlantic Coast.

Northwest Passage

Another development directly related to global warming is the emergence of a viable Northwest Passage, for centuries the dream of northern countries bordering the Arctic, including Canada, the United States, the Scandinavian countries, Russia, Iceland, and Greenland. This alternative sea route has only opened up in the past several years, largely due to the ever warming Arctic region. It is an alternative sea route along the northern coast of North America via waterways amidst the Canadian Arctic Archipelago, connecting the Atlantic and the Pacific Oceans. Until 2009, Arctic ice precluded its regular use but with reduced ice pack the waterways have become more navigable.

Trans-shipment Hub

Several ports in the Caribbean as well as Freeport in the Bahamas are positioning themselves to become a trans-shipment hub for the mega-ships with cargoes destined for the ports on the East Coast of the United States. The Bahamas Freeport Container Terminal planned expansion is forecast to grow over 400 percent in the next two years, expanding from 2 to 20 berths in the next decade. Others in this competition include Mariel Port, Cuba, that is expending \$.9 billion in a new port, trans-shipment/logistics center and container terminal being constructed by Brazil's Odebrecht. Kingston, Jamaica, is undertaking the Jamaica Logistics Hub Project, which is a multi-faceted program of improvements: dredging Kingston Harbor to 57.4 ft.; expanding port facilities at Port Augusta, Gordon City, and a 20 hectare expansion of the West Terminal; development of a dry dock at Jackson Bay; creating a trans-shipment commodity port near Yallahs, St. Thomas; establishing the Caymanas Economic Zone; and developing an air cargo/passenger facility at Vernamfield, Clarendon. They are being assisted in their efforts by officials and technical advisors from China, Singapore, and the Netherlands. Their goal is to develop a logistics hub for the Western Hemisphere. Another option under consideration is Mariel, Cuba, where a new \$900-million port, including a deep water container terminal and a Free Trade Zone (FTZ), are being developed. The FTZ is being modeled after a successful development in Shanghai and may

include Asian investors/developers. Finally, on December 13, 2013, the U.S. Citizenship and Immigration Services approved the Louisiana International Gulf Transfer Terminal (LIGTT) which will allow the development of the largest transshipment facility in the United States to be located at Mile 0 on the LMR and having a navigable depth of 70 ft. [31]. Which port becomes the new trans-shipment hub is currently just one more unknown in the evolving post-Panamax world.

CONCLUSIONS

For ports along the U.S. Gulf Coast, as well as those located along the East Coast, opinions vary widely on the impact of the Panama Canal Expansion on the container trade. Executives from west coast ports believe that there will be no impact as shippers have already made up their minds to stick with a known success: deep draft west coast ports coupled with various land bridges to the Midwest or the East Coast. Their peers at competing ports beg to differ. They see the PCE as a game changer and they are spending billions of dollars anticipating the arrival of the 2.5 million new containers introduced into the Gulf and the East Coast by the Panama Canal Expansion. Who is right remains to be seen. But for Louisiana and coastal ports, the main changes brought about by the PCE will be the size and variety of ships that will be able to transit the canal and the commodities they transport. These vessels will be bigger, deeper, and will carry far heavier loads. Due to burgeoning populations in China and other Asian countries, agricultural and energy commodities will experience exponential growth over the next few decades. Of significance for Louisiana will be corn, soybeans, distillers dry grain, thermal coal, and the newly emerging economic giant: LNG used both as an industrial feedstock and as a fuel. Louisiana-based LNG export terminals have recently been licensed by the federal government to sell to non-FTA countries and will be the first beneficiaries of the expanded canal. Once open, the widened canal will allow 80 percent of the LNG carriers to use the route, saving both days in transit and significant costs.

Stan Swigart, manager of Business Development for the Port of Houston Authority, was recently asked what he thought about the new post-Panamax world. He responded by sending to UNOTI the latest statement from PCA Vice President for Marketing and Research, Rodolfo Sabonge. At a recent South Carolina International Trade Conference, Sabonge noted, “The biggest growth cargoes will be dry and bulk cargoes that will transit the PCE and transshipment container cargo moving in the north-south trades [32].” Beyond that, everything else is up in the air and will be until 2016 or 2017, when the maritime world will have adjusted to the new realities of the post-Panamax world.

RECOMMENDATIONS

There currently exist a number of initiatives directly related to maritime commerce, international trade, and marine infrastructure enhancements that will positively impact Louisiana. These need to be strongly supported by DOTD, LED, the WTCNO, and elected officials at all levels of government. Initiatives include:

- Support the PONO in their efforts to have the Army Corps of Engineers dredge the river bottom next to the Napoleon Avenue Container Terminal to match the depth of the Mississippi River Navigational Channel.
- Support the Big River Coalition's proposal to dredge the Mississippi River downriver of Baton Rouge to a depth of 50 ft. as was recently evaluated by Tim Ryan in his recently released report co-sponsored by DOTD. Ryan estimates that every dollar spent on this effort would return \$89.40 in benefits [33].
- Support and closely monitor the ongoing Master Plan for International Commerce being developed under the direction of the Louisiana Department of Economic Development, their consultant and the recently Governor-appointed Task Force. This effort has been awarded a \$1 million grant from the Commerce Department and \$1.6 million from the U.S. Small Business Administration's State Trade and Export Promotion program [34].

U.S. Congressman Charles W. Boustany, Jr. MD (R-Southwest Louisiana) introduced in January 2011 the RAMP Act that guarantees the funds collected annually by the Harbor Maintenance Tax on imports at U.S. ports are allocated by Congress for the sole purpose of dredging and maintenance. The bill is co-sponsored by Louisiana Republican Rodney Alexander, Bill Cassidy, Steve Scalise and John Fleming. The Senate version has 21 co-sponsors including Louisiana Senators David Vitter and Mary Landrieu. Elected officials at all levels of government within the state of Louisiana should support the RAMP Act.

The potential growth in bulk exports from Louisiana is great. DOTD should investigate a publicly funded investment program to enhance the export of bulk commodities in traditional vessels. This program should complement the massive investments in plant expansions, private terminals and related infrastructure by the private sector (both domestic and international) being built along the coast and the LMR.

Lastly, the Louisiana International Gulf Transfer Terminal needs to be supported at all levels of government. This project could ultimately impact the entire Mississippi River and its associated tributaries with enhanced levels of trade, America's competitiveness and increased shipping demand. A complete summary of the project was recently released in Dredging Today.com [35].

ACRONYMS, ABBREVIATIONS, AND SYMBOLS

AWP	All Water Panama
AWS	All Water Suez
CIF	Cost, Insurance, and Freight
DOTD	Louisiana Department of Transportation and Development
FHWA	Federal Highway Administration
FTA	Free Trade Agreement
FMC	Federal Maritime Commission
FTZ	Free Trade Zone
JOC	Journal of Commerce
LED	Louisiana Economic Development
LIGTT	Louisiana International Gulf Transfer Terminal
LMR	Lower Mississippi River
LNG	Liquefied Natural Gas
LTRC	Louisiana Transportation Research Center
NSR	Northern Sea Route
PCA	Panama Canal Authority
PCE	Panama Canal Expansion
PIERS	Port Import/Export Reporting Service
PONO	Port of New Orleans
PVC	Polyvinyl Chloride
RAMP	Realize America's Maritime Promise
TCI	Transportation Consultants Inc.
TEU	Twenty-Foot Equivalent Unit
USCIS	U.S. Citizenship and Immigration Services
UNOTI	University of New Orleans Transportation Institute
USWC	U.S. West Coast
WTCNO	World Trade Center New Orleans
Bcf/d	billion cubic feet per day
bpd	barrels per day
bph	barrels per hour
dwt	dead weight ton
mtpa	million tons per annum
mtpy	million tons per year
tpy	tons per year

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APPENDIX

A comparable spreadsheet of port infrastructure projects throughout the Americas can be found online at http://www.ltrc.lsu.edu/pubs_final_reports_5.html as a separate link under Final Report 523 (LTRC Project Number 13-7SS).

