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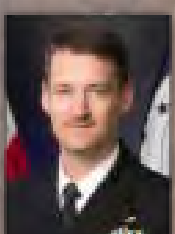

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China Exchange

Beijing, Tianjin, Nanjing & Shanghai

July 26 – August 3, 2014

Listening, Inspecting, Partnering & Engineering since 1879

China Dialogue and Exchange
Beijing, Tianjin, Nanjing & Shanghai
July 27 - August 3, 2014

The Mississippi River Commission's exchange with China July 27 – August 3, 2014, was a major success. The visit was a joint effort between the Mississippi River Commission and the U.S. Army Engineer Research and Development Center's Coastal and Hydraulics Laboratory (ERDC-CHL), and included stops in Beijing, Tianjin, Nanjing and Shanghai.

The Coastal and Hydraulics Laboratory is a national resource that provides experimental and computational expertise for solving water resource problems worldwide. CHL is one of seven laboratories that form ERDC. The long-standing relationship between the commission and ERDC-CHL dates back to ERDC's origins (1929).

The two organizations were invited by the China Water Transportation Construction Association and the Tianjin Research Institute for Water Transport Engineering, and was coordinated with the State Department and U.S. Embassy in Beijing-Shanghai.

The trip was made to discuss technological innovations in marine transportation engineering, focusing on harbor engineering; estuaries and waterway management; disaster prevention and mitigation in waterway engineering; and environmental protection. Additional areas of interest included large-scale physical modeling for navigation and estuaries.

Experts from the United States, Germany, the Netherlands, Japan, China, Panama, Hong Kong and other countries participated in the joint exchanges.

Observations

The people and their desire to understand and improve is high. They are learning everything they can concerning infrastructure investment from the success of other countries; e.g., Germany, the United States and the Netherlands, to name a few. They are learning AND they are building or have built enormous infrastructure with a vision for current AND future economic expansion.

China's investment in water infrastructure is MASSIVE. They are betting it all on the ability to effectively import and export with the largest of ships, using the most aggressive loading and unloading facilities that will accommodate container-on-barge and any other conceivable method of shipping.

They have built, and continue building, housing and support facilities for millions of workers and associated support and leadership teams who will run and maintain the infrastructure. They are pursing waivers for everything possible to incentivize people and companies to use the "resort type" areas that exist in the port complex footprint.

The amount of channel maintenance will be costly but may pale in comparison to the benefits of bulk commercial and military transportation opportunities and savings.

It appears from an outside view that you could run and influence the success or the strategic lack of provision of entire countries from the port complex's like the one in Tianjin.

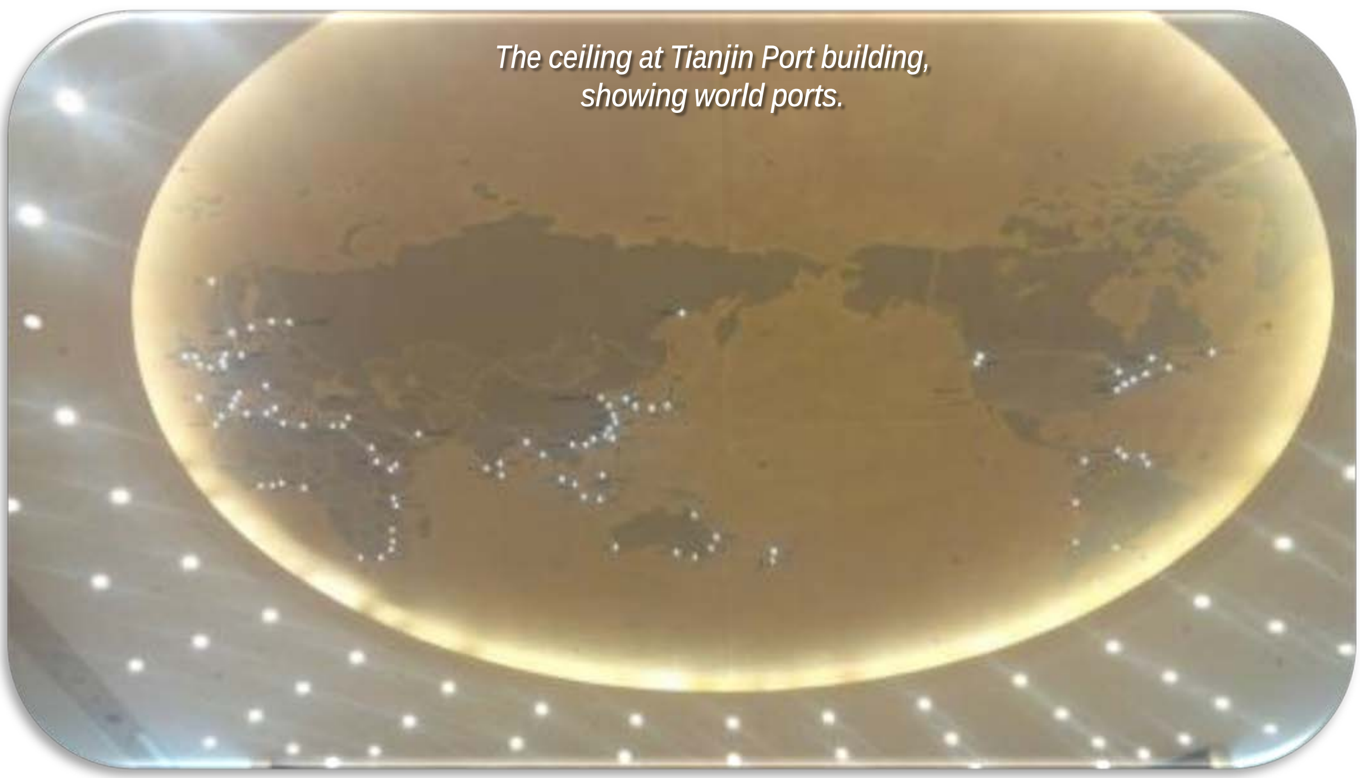
Tianjin
Tuesday, July 29, 2014

Tuesday, Mr. Stephen Gambrell participated in an international meeting on estuary management hosted by the Tianjin Research Institute for Water Transport Engineering.

During the group's exchanges, Mr. Gambrell discussed much of what the Mississippi River Commission has learned over the last 135 years – such as, during the commission's thought/planning process it must include biologists, attorneys, politicians, businesses, industry, locals (humans and creatures) and others that might benefit or be impacted, so that the results, impacts and benefits will be more future focused and less focused on the immediate need of a single person or group or crisis.

In other words, a more balanced approach is needed to water and its local, regional and system-wide values and benefits -- more watershed wide in consideration.

But as with every intervention in a hydrological system, there are reactions to every action, and each generation has to learn how to respond to a new set of challenges while being ever so careful not to discount or discard the benefits derived from prior actions. This is why it is essential to productively engage as many partners, allies, stakeholders, friends and even those that don't agree in the process; it will help ensure a future that will benefit our children's children.



The ceiling at Tianjin Port building, showing world ports.

Tianjin
Tuesday, July 29, 2014

Mr. José E. Sánchez, PE, SES (director of the Engineer and Research Development Center's Coastal and Hydraulics Laboratory) gave a presentation at the International Marine Transportation Engineering Symposium entitled: Research and Development of Innovative Technologies for Large River and Estuarine Systems in the United States.

The briefing focused on the organizational context and four sample research efforts conducted at ERDC's Coastal and Hydraulics Laboratory related to large river and estuarine systems in the United States.

Special emphasis was given to the complexities that are inherent in large river systems and the need to use various tools and techniques to understand the complex conditions that exist in these environments. The tools and systems presented provided attendees an opportunity to be exposed to engineering solutions designed to evaluate alternatives and develop design guidance to maintain safe navigation in the United States of America.

Physical model of Tianjin Port

Tianjin
Tuesday, July 29, 2014

Tuesday, Messrs. Gambrell and Sánchez participated in an international meeting on estuary management hosted by the Tianjin Research Institute for Water Transport Engineering.

Participants included:

- Charles W. W Ng, Ph.D., Hong Kong University of Science & Technology
- Gao Min, Yangtze Estuary Waterway Administration Bureau, MOT
- Sun Ziyu, China Communications Construction Company Limited
- Brian Brendel, ESTH, United States Embassy, Beijing
- J. Kayser, Germany
- Kojiro Suzuki, Maritime Structures Laboratory
- Juan Wong, Panama Canal Authority

Tianjin
Tuesday, July 29, 2014

Tuesday, Mr. Stephen Gambrell and Mr. José Sánchez participated in a site visits to the Tianjin Port & Exhibition Center and the Tianjin Port artificial sand beach.

Tianjin model port

Tianjin Port building

Tianjin
Wednesday
July 30, 2014

Tianjin model port.

Tianjin
Wednesday
July 30, 2014

Wednesday, Mr. Stephen Gambrell and Mr. José Sánchez participated in a site visit to the Large Hydrodynamic Research Center in Tianjin.

The center houses a large wave flume that is 450 meters in length, five meters wide and 12 meters deep. The wave flume is capable of generating regular and random wave heights of up to 3.5 meters in height with periods of two to 10 seconds and a current with a discharge rate of up to 20 cubic meters per second.

This allows the center to conduct prototype-size (not scaled) experiments on structures, such as floating platforms. While there, Gambrell and Sánchez witnessed a sample run of the experiments being conducted to measure mooring forces on anchoring lines for platforms scheduled to be installed in the Port of Tianjin.

Above: Large wave flume at the Large Hydrodynamic Research Center in Tianjin

Below: Wave flume test at the Large Hydrodynamic Research Center in Tianjin

Above: Flume test floating section at the Large Hydrodynamic Research Center in Tianjin

Nanjing
Thursday, July 31 & Friday, August 1, 2014

Thursday, Mr. Stephen Gambrell and Mr. José Sánchez traveled to the Tiexinqiao Water Experiment Center (WEC) for briefings by the Nanjing Hydraulic Research Institute on their operations and projects.

The institute appears to share many similar features as those located at the Waterways Experiment Station and contains large estuary physical models, such as the Yangtze Estuary model and other unique laboratory equipment that allows them to conduct one-of-a-kind research, such as high-velocity unsteady flow vacuum experiments.

Later in the day, Messrs. Gambrell and Sánchez traveled to NHRI headquarters where they delivered presentations and engaged in dialogue and exchanges with NHRI scientists.

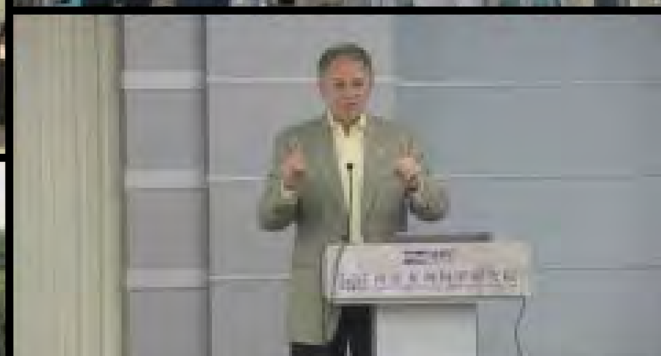
Friday morning, Messrs. Gambrell and Sánchez toured the original city walls of Nanjing, and learned of the city's transitional periods (served as China's capitol ~eight times).

Above: Nanjing water structure.

Left: A section of the old city wall at Nanjing.

Nanjing
Thursday, July 31, 2014

Mr. Stephen Gambrell, director, Mississippi River Commission and Mr. Jose Sanchez, director, Coastal and Hydraulics Laboratory, U.S. Army Engineer Research and Development Center, visited NHRI July 31, 2014.



Shanghai
Friday, August 1, 2014

Friday, Messrs. Gambrell and Sánchez traveled to Shanghai where they visited the physical scale model of the Yangtze River.

The representation was impressive, as it was well over three acres in size.

The model has been in operation for several years and has been used to study the hydrodynamic conditions in the Tianjin port navigation channels and estuary.

Saturday, August 2, 2014

Saturday morning Messrs. Gambrell and Sánchez participated in a field trip to the Yangtze Estuary by officials of the Yangtze Estuary Waterway Administration Bureau.

During the afternoon, they participated in a technical seminar hosted by the bureau. Both Mr. Gambrell and Mr. Sanchez gave presentations.

Questions throughout the visit pertained to these topics: dredging methods and types of dredging, costs, contracts, quantities, regulations, module techniques and uses, advanced technology for riverine channel development, changes to climate and how to incorporate into future engineering, ship size and ability to offload all types of cargo.

Foyer area of the Tianjin Port building

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Research and Development of Innovative Technologies for Large River and Estuarine Systems in the United States

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Abstract

The Coastal and Hydraulics Laboratory is the largest laboratory devoted to water resource issues in the United States. This document describes the organizational context and research at the Coastal and Hydraulics Laboratory as it relates to large river and estuarine systems in the United States. Examples of four approaches being applied to study large river and estuarine systems are discussed: analytical (the river-side effects of river diversions in the Mississippi River Delta), integrative spatial (geomorphic assessment of the Lower Mississippi River), data integration (bed-load transport measurement in the Missouri River near Kansas City, Missouri), and numerical modeling (salinity intrusion into Mobile Bay, Alabama). These four approaches provide examples of large river and estuarine research and development activities intended to inform sustainable management and development of water related resources for the nation's benefit and the people's well being.

Overview

For over 230 years, the U.S. Army Corps of Engineers (USACE) has been tasked with the development and stewardship of much of the United States' public water resources. The USACE Civil Works Program plans and manages water resource projects for transportation, recreation, energy, wildlife habitat, aquatic ecosystems, and water supply, while reducing the risks associated with floods and other natural disasters. In 2014, the USACE total allocation for civil works was $4.7 billion, mostly for water resource project development. As with many other engineering organizations, research and development (R&D) are essential requirements for solving complex problems encountered during the design, maintenance, and operation of its water resources assets. To this end, the USACE maintains an R&D capability at the U.S. Army Engineer Research and Development Center (ERDC). The ERDC provides science, technology, and expertise in engineering and environmental sciences in support of the Armed Forces and the United States of America. The ERDC is composed of seven laboratories. The ERDC laboratories include:

- Coastal and Hydraulics Laboratory—Vicksburg, Mississippi
- Environmental Laboratory—Vicksburg, Mississippi
- Geotechnical and Structures Laboratory—Vicksburg, Mississippi
- Information Technology Laboratory—Vicksburg, Mississippi

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- Topographic Engineering Center—Alexandria, Virginia
- Cold Regions Research and Engineering Laboratory—Hanover, New Hampshire
- Construction Engineering Research Laboratory—Champaign, Illinois

The four Vicksburg laboratories are located at the Waterways Experiment Station. This paper will present an overview of some of the research being conducted at the Coastal and Hydraulics Laboratory (CHL) as it relates to inland navigation and river engineering, which is one of the main missions of the USACE.

CHL solves interdisciplinary, strategically important problems of the USACE, Army, Department of Defense and the United States of America by providing the best solutions to water resource challenges through the design and application of cutting-edge science, engineering and technology. The research conducted at CHL addresses water resources challenges in groundwater, watersheds, rivers, reservoirs, lakes, estuaries, harbors, coastal inlets, and wetlands. Physical modeling facilities of approximately 160,000 square meters, state-of-the-art computational capabilities and over 200 staff members are the basic infrastructure for producing cutting-edge products for successful coastal and inland water resources investigations. Research projects range from the development of design guidance to the creation of three-dimensional numerical models with unique capabilities. Research emphasis is placed on navigation, flood risk management, storm and erosion protection, fish passage, hydro-environmental modeling, water/land management, and other water and sediment-related issues.

In fiscal year 2014, ERDC's civil works R&D allocations from USACE are $77 million of which $40 million is administered by CHL. Combined with an estimated $25 million coming from other sources, such as other USACE elements and U.S. government agencies, the total annual research budget for CHL is projected to be $65 million in 2014.

Research Approach for Large River and Estuarine Systems

The CHL of today was established as the Waterways Experiment Station in 1929 in response to one of the nation's most destructive natural disasters—the Great Mississippi River Flood of 1927—which killed 246 people in 7 states. The findings from hydraulic research on the Mississippi River from 1929 to the present have been and will continue to be crucial to saving thousands of lives and billions of dollars in annual damages. In fact, $234 billion in flood damages was prevented by the Mississippi River and Tributaries Project during the 2011 Mississippi River flood alone (U.S. Army Corps of Engineers 2012).

In addition to the Mississippi River, CHL continues to address other large river and estuary research problems to provide better tools for successful execution and management of navigation and environmental, as well as flood, projects. Four innovative approaches to large river and estuarine water resource related issues are discussed here. The approaches include: an analytical technique for investigating the riverside effects of sediment diversions; a spatial technique for evaluating long-term river morphology; a data integration technique for quantifying bed-load transport; and a numerical modeling technique for determining the salinity intrusion in an estuarine navigation channel.

Analytical Methods for Determining the River-side Effects of a Sediment Diversion on a Large River

CHL researchers (Brown et al. 2013) developed an analytical treatment of an idealized sediment diversion. The driving research question was how a diversion from the Mississippi River, such as the West Bay Diversion located on the lower section of the river (Figure 1), could optimize the quantity of diverted sediment for coastal wetland land-building efforts without compromising navigation requirements within the Mississippi River. The results can be used to provide a preliminary assessment of the riverside effects of a sediment diversion.

The following bullet points provide a simplified summary description of various ways in which different sediment diversion efficiencies will impact the river morphology upstream and downstream of the diversion site for a constant river width:

- **Short-term response**—degradation (erosion) upstream of the diversion and deposition downstream.
- **Long-term response** when the sediment diversion efficiency *is larger than* (>) the sediment diversion efficiency for equilibrium conditions—significant degradation (erosion) upstream and downstream of the diversion.
- **Long-term response** when the sediment diversion efficiency *is equal to* (=) the sediment diversion efficiency for equilibrium conditions—moderate degradation (erosion) upstream of the diversion and mild deposition downstream.
- **Long-term response** when the sediment diversion efficiency *is less than* (<) the sediment diversion efficiency for equilibrium conditions—mild degradation (erosion) upstream of the diversion and moderate deposition downstream.
- **Long-term response** when the sediment diversion efficiency *much less that* (<<) the sediment diversion efficiency for equilibrium conditions—significant deposition upstream and downstream of the diversion.

Figure 1. Mississippi River West Bay Diversion. Photo by Eliot Kamenitz, NOLA.com | THE TIMES PICAYUNE archive.

At the onset of diversion operations, the river begins to scour upstream of the diversion and deposit downstream of the diversion. The results of the equilibrium diversion analysis show that this short-term response will occur regardless of the sediment diversion efficiency. In contrast to this, the way in which this short-term response of the river morphology progresses to a long-term adjustment is dependent on the sediment diversion efficiency. In all cases, there is some adjustment of the river morphology upstream and downstream of the diversion site. This is even true for the equilibrium case.

Integrative Spatial Methods for Geomorphic Assessment of the Lower Mississippi River

CHL researchers (Little and Biedenharn, in preparation) developed an innovative geomorphic assessment that integrates data across multiple disciplines to provide a comprehensive understanding of the stability of the Lower Mississippi River. For nine river reaches and four time periods (1960s–1970s, 1970s–1990s, 1990s–2000s, and 1970s–2000s) the channel geometry, specific gauge data, and probabilistic sediment budget were integrated to obtain a composite stability assessment for each reach. Stability was divided into the following five broad categories: aggradation, trending aggradation, dynamic equilibrium, trending degradation, and degradation. Figure 2 shows the reach stability assessment for the Lower Mississippi River for the 1970s–2000s. This assessment also included documenting historical trends in hydrology, sedimentation, and channel geometry and summarizing the local changes observed at locations where repetitive datasets exist and at key reaches.

Coastal Louisiana, USA, has a multitude of water resources problems and opportunities. Among them include a complex network of levees and diversions, degrading coastal wetlands, stringent navigation requirements, and a high risk of hurricanes. The Mississippi River Hydrodynamic and Delta Management Feasibility Study is developing tools that can evaluate both the existing conditions of the Mississippi River and any potential local and system-wide impacts of proposed changes to the system. As part of this effort, CHL is involved in a collaborative effort to develop a comprehensive numerical modeling system to assess potential restoration alternatives and determine the availability of fresh water, sediment, and nutrients for restoration usage without compromising flood risk management and navigation missions. The Little and Biedenharn geomorphic assessment of the Lower Mississippi River was conducted as part of this comprehensive approach.

Figure 2. Lower Mississippi River geomorphic reach stability assessment, 1970s–2000s.

Data Integration for Sediment Bed-load Transport Measurements in the Missouri River near Kansas City, Missouri

CHL researchers (Abraham et al. 2011) have developed the Integrated Section, Surface Difference Over Time version 2 (ISSDOTv2) technique, and a corresponding software application, to compute bed-load transport in sand-bed streams with dunes using bathymetric data. Traditionally, assessments of bed load sediment transport are done by measuring sizes and migration rates of dunes over a large enough area and over a suitable length of time; such measurements are difficult and uncertain. The CHL method instead measures rates of bed erosion or scour associated with dune migration by comparing time-sequenced bathymetric data of the river bottom. This ISSDOTv2 method is equally or more accurate, as well as more efficient, than the bed-load transport calculations determined from measurements of bed-form amplitude and speed. This new approach results in better estimates and timing of sand availability for commercial sand mining, coastal land-building, dredging, and river sediment transport in general.

Sands moving in the bed of a river are no longer viewed simply as a nuisance causing expensive dredging in navigation channels. River engineers and managers are now asked to allocate bed sediment resources to a variety of competing purposes and interests including in-stream habitat, wetland land-building efforts in coastal areas, and commercial sand mining. They must address all these concerns in addition to the navigation requirements of maintaining adequate draft depths in the navigation channels and functionality of the locks and dams. In order to adequately address all of these various interests, river managers must have some idea of how much bed material is available and moving through a river system. If the mass transport rate can be determined and related to changes in river flow, then a bed-load rating curve can be produced. This knowledge provides a quantitative management tool for those tasked with allocating the river's sand resources.

Figure 3 shows data resulting from a four swath survey of the Missouri River near Kansas City, USA. Analyses of these data enable, for example, the quantification of bed load transport quantities in different portions of the river. In this case, 78% of the bed load transport occurs over 55% of the channel, 14% is transported over 23% of the channel, and 8% is transported over the remaining 22% of the channel. This kind of information contributes to better management of the sediment resource.

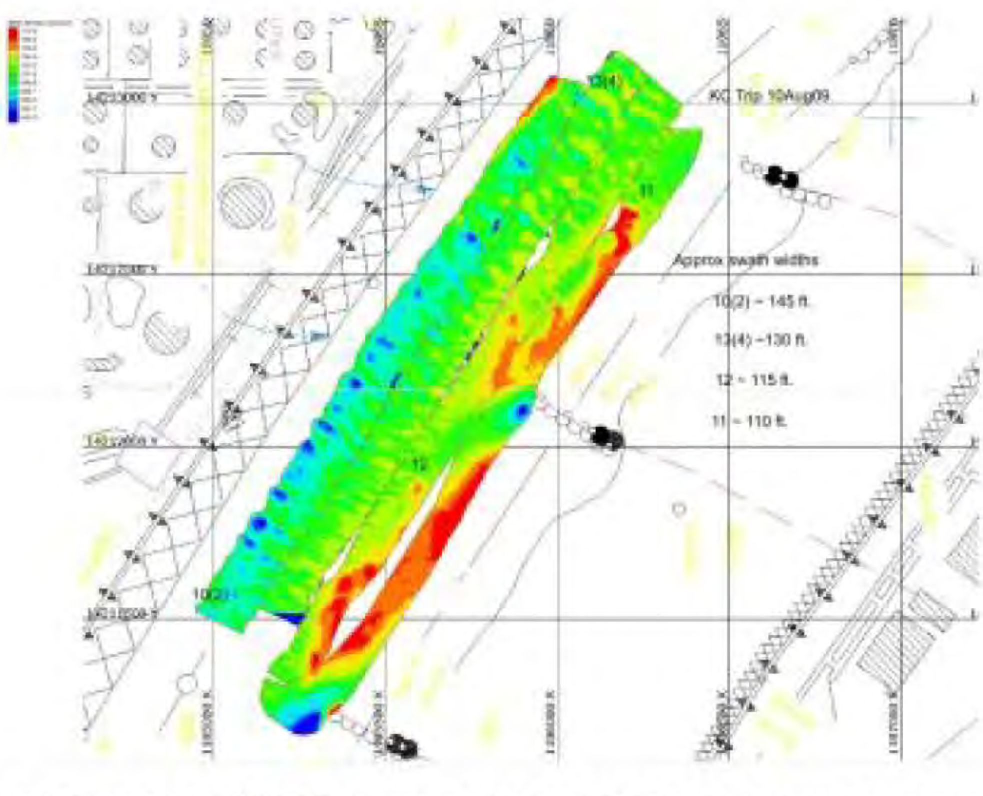

Figure 3 Example of ISSDOTv2 bathymetric input for bed load transport calculation

Numerical Modeling of Salinity Intrusion into Mobile Bay, Alabama

Researchers at CHL have developed a state-of-the-art multi-dimensional hydrodynamic and transport code for use in water resource projects involving navigation, flooding, and environmental restoration. The code, Adaptive Hydraulics (ADH), is suitable for the calculation of hydrodynamic variables such as water levels and velocities, transport variables such as salt and sediment, and includes many libraries for use in solving problems involving sediment bed behavior, structures, navigation, water quality, ecology, turbulence, etc. (Berger et al. 2013) A unique feature of the ADH code is its ability to adjust the spatial and temporal resolution (computational mesh and time step) as the calculations proceed; this means that the resolution is appropriate for the calculational environment at hand, and it can change as the calculational environment evolves. Improvements to navigation channels in estuaries often result in additional salinity intrusion into the estuarine system, and this intrusion may impact the quality of the water with potential impacts to the local ecology and the suitability of the water for use in industry, agriculture, and drinking. Salinity intrusion is generally a three-dimensional process, and the ADH code provides a three-dimensional, physics based tool for use in modeling the hydrodynamics and transport of salinity in an estuary with navigation infrastructure. Thus, impacts due to navigation infrastructure can be gauged and mitigation planned before construction begins. The salinity intrusion in to Mobile Bay, Alabama provides an example of such a study. Figure 4 locates Mobile Bay in relation to New Orleans, Louisiana, and the Gulf of Mexico. Figures 5, 6 and 7 show surface, bottom, and bottom minus surface salinity fields as calculated with ADH. The impact on the intrusion of a deep draft channel (12 meters) through a shallow bay (2 meters) is apparent.

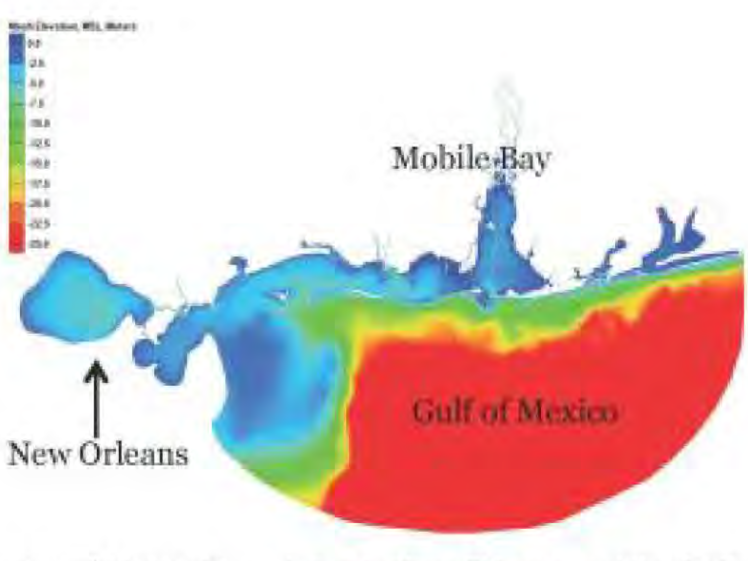

Figure 4. Location of Mobile Bay relative to New Orleans and the Gulf of Mexico using the calculational mesh domain with bathymetry

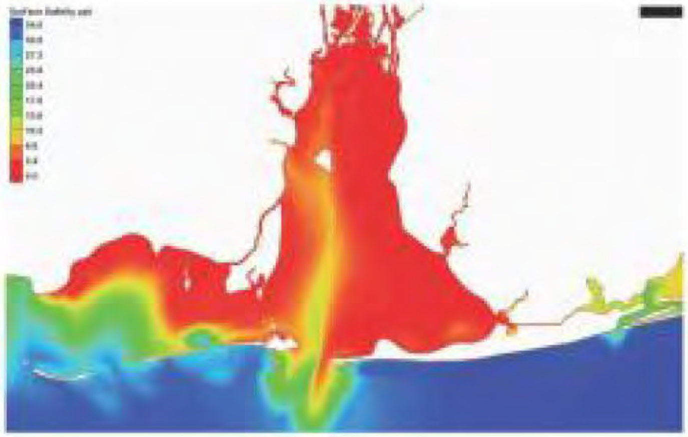

Figure 5. Mobile Bay Surface Salinity

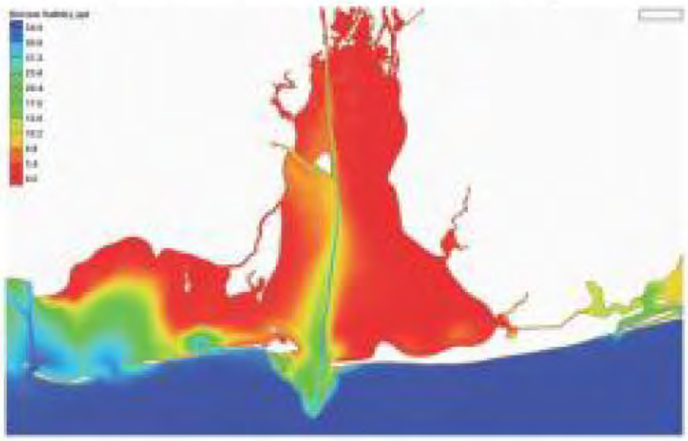

Figure 6. Mobile Bay Bottom Salinity

Figure 7. Mobile Bay Salinity Stratification (bottom salinity – surface salinity)

Summary

The Coastal and Hydraulics Laboratory (CHL), as part of the U.S. Army Corps of Engineers (USACE), has been involved since its inception in the development and application of state-of-the-art and state-of-the-practice methods for addressing water resource challenges related to navigation, flooding and environmental restoration in large rivers and estuaries. The studies presented demonstrate the value of a multi-faceted approach (field studies, analytics, numerical and physical modeling).

CHL researchers have developed an innovative geomorphic assessment that integrates data across multiple disciplines to provide a comprehensive understanding of the historical stability for several reaches of the Lower Mississippi River to assist engineers manage large navigable waterways.

Sediment in river systems is no longer viewed as a problem related to dredging. It has become an important resource with many positive uses. As such, research has been conducted to improve estimates on quantity and transport of it. In rivers such as the Mississippi, research efforts demonstrate that a simplified analytical approach can be utilized to evaluate engineering alternatives intended to optimize the quantity of diverted sediment for environmental restoration (land building) without compromising navigation requirements. CHL researchers also developed a new tool to improve estimates and timing of sand availability for commercial sand mining, coastal land-building, dredging, and river sediment transport. The method uses time-sequenced-bathymetric swaths coupled with physics-based computations to capture the total bed-load transport. This kind of information contributes to better management of the sediment resource in large river systems.

Recent research efforts conducted at CHL have significantly improved multi-dimensional modeling, making it an even more effective and computationally efficient tool to evaluate impacts to navigation due to salinity intrusion caused by projects that change the geometry of the channel. The complexities that are inherent in large river systems require the use of various tools and techniques to understand the complex conditions that exist in these environments. The tools and systems presented have assisted the USACE in evaluating alternatives and developing design guidance to maintain safe navigation in the United States of America.

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Introductory Address:

For the leaders and participants of this dialogue setting, we are impressed with your expertise and grateful that you allow us to be a part of this exchange.

I am an engineer by label or at least my wife seems to believe that I was born with that affliction ... So, I am "naturally" square brained. There appears to be no known cure. In other words … things must add up, there are such things in life as schedules … and whether my wife and 7 year old son agree or not … it is possible to produce and stick to a schedule. What we in the MRC have discovered over the last 135 years is that we must include biologist in our "calculations" and not only those strange creatures … from our square brained perspective, but … attorneys, and politicians, and businesses, and industry, locals (humans and creatures) and others that benefit and or are impacted, so that the results, impacts and benefits will be more future focused and less on the immediate need of a single person or group or "crisis". In other words more balanced in an approach to water and its great local, regional and system wide values and benefits … more watershed wide in consideration.

According to John Briscoe at Harvard University's Environmental Engineering school … The history of the Mississippi River shows these conclusions at work:

- The "original" challenge of navigation was addressed, through both infrastructure and institutions, and continues to present great economic and social benefits on the United States to this day;

- The challenge of creating protected and productive agricultural land was achieved with lasting economic and social value;

- After the Great Lower Mississippi River flood in 1927 the expression of the "make way for the river or room for the river" philosophy and the corresponding infrastructure (through the Mississippi Rivers and Tributaries project (MR&T)) and institutions (in the form of the Mississippi River Commission (MRC), and its regular systematic engagement with local levee boards, and in the form of the processes embedded in the MR&T) was, again, an extraordinarily innovative and effective response to a massive social and economic challenge. This "room for the river" approach devised and implemented over the last

85 years proved its value in the Mississippi River's 2011 flood where not one life was lost and more than $234 billion dollars of damages were avoided.

But as with **every** intervention in a hydrological system, there are reactions to every action, and each generation has **to learn how to respond to a new set of challenges** while being ever so careful not to discount or discard the benefits derived from prior actions. In the case of the Mississippi the list is, and it probably always has been, long and sobering.

So, some people say that no action is the answer to some of our world watersheds and systems … be careful about that …

In the absence of a comprehensive "watershed" level approach to action … activity happens. It results in decisions and actions by thousands or even millions of people, one at a time … removing sediment from their local flood plains for personal or commercial uses, introducing system altering products from homes, farms and businesses that overcome the dilution potential of the river water. So, no action does not mean that activity or impact will not or does not occur.
If we focus on just one or two of the many causes of loss then the many other causes may deliver just as much loss … yet cost a nation by the short sighted focus on the few … its people, money, time and other resources could be better spent in more productive ways.

It is essential to productively engage in the process … as many partners, stakeholders, allies, friends and even those that don't agree … most people and countries want to accomplish productive activity for the future that will benefit our children's children that follow.

So, for all of us who want simple, easy and instant solutions. There are none … there is no such thing as simple … but, I can't resist … here's one … understanding that there is nothing simple about our challenges … allow me to provide a "square brained" attempt with three observations:

- Gather the best science available to-date and consider it … a very wise sediment transport scientist, once said … "models are for insight not answers" ... so use the insight gained from great watershed's, delta's ... and yes, even models

- Streamline or agree on a process to deliver solutions that includes **INPUT** from the broad array of people, states, countries and other relevant well meaning end users and beneficiaries.

- Build the case with proofs to invest in high value, high return watershed wide endeavors

The power point slides and the references that are appended provide context with much more detail for your use and consideration. Thank you for your interest, work, contribution and sincere desire to make a difference for the future of people and their environment, in your back yard and around the world.

Your kind attention is most appreciated.

Additional Remarks and observations for interested water dialogue partners and stakeholders:

For the leaders and participants of this dialogue setting, we are impressed with your expertise and grateful that you allow us to be a part of this exchange.

I have spent my career working on, with, and around rivers and the people that are impacted and benefit from them. I have traveled in 24 countries observing firsthand the people and the waters' that provide life for the basic needs of the families it supports and land on which they depend ...

My observations are influence by the work of a respected academic and world water thinker ... and recipient of the "Nobel Prize" for water this year, Dr. John Briscoe of Harvard University. In the Mississippi Watershed we have worked closely with Harvard's Water Security Initiative and Prof Briscoe. As Dr. Briscoe observes "practitioners never read and academics never practice". So this is an attempt to be more of a "thinking practitioner".

Dr. Briscoe and his Harvard team published a thoughtful piece based on international water security research that assesses and compares water histories and challenges across five significant world river basins, along with the institutions and infrastructure that arose from those challenges. One of them was the Mississippi River basin. I will use some of his findings to provide context and perhaps help frame some of our discussions. They are:

In the river basins studied …

- Development was initially motivated by the need to reduce water insecurity, particularly the frequency and impacts of droughts and floods, and to build a water platform for economic growth. They spawned the institutions and infrastructure that exists today.

- Success in meeting the original challenge gave rise, over time, to a new set of challenges, which arose largely because of the success of the original responses.

- <u>Options for the future are dependent on what now exists</u>, in terms of both institutions and infrastructure. Briscoe's analysis deduced … effective approaches can't start with a blank sheet of paper, but must take into account the institutional and psychological residues of history. He quotes Harvard biologist E.O. Wilson in stating the contemporary challenge is that we have God-like technologies, medieval institutions, and Paleolithic emotions.

- <u>Values change over time</u> with the level of economic development. Enduring infrastructure and institutions evolved from a time when land settlement and economic growth were the overwhelming regional and national priorities. The reality is that as societies become affluent, they no longer worry so much about the basics – enough food, water, energy – and turn their attention to more environmental concerns because they can now afford to do so. We have a current generation in the US that has never known deprivation of water, food or energy. As a result, secure food and energy are now taken for granted and the role of water management in securing these is obscure at best.

All water management solutions are provisional. Many of us come to the issue of water with a strong sense that much of what has been done in the past was wrong, and that the "new" ideas (sustainability, climate change, integrated water management) provide a better framework for correct change. But Prof Briscoe says a longer historical view suggests there is nothing particularly special about this era and that the history of water management is a history of challenges (which change over time) and response.

So stepping back into a Mississippi River practitioner role, I'll attempt to apply a lifelong personal quest and over three decades of experience to make a few observations about the Mississippi River, in light of Professor Briscoe's work.

First, Mississippi River affiliations tend to be somewhat tribal in nature. River people tend to be part of the Flood Control tribe, the navigation tribe, the recreation tribe, the environmental tribe, the lower river, middle river and upper river tribe, etc ... I think you understand where this is going. While each routinely interacts and often closely partners with others, their values and loyalties are shaped by their primary affiliation. So there can be this splintered view of the Mississippi River and its value across those disparate affiliations. The good news is that we've found the Mississippi River doesn't really divide us, it generally unites us. And just like in many countries, disparate tribes can and do come together to overcome a common adversary, and so they can across the Mississippi River Basin. We must fully exploit the uniting capacity of our great rivers using approaches that are more collaborative and inclusive across all "tribes", rather than divisive and conflicting between them ... because economic oriented groups and ecosystem oriented groups need each other to achieve their respective goals. To quote Prof. Briscoe, "an effective change will take place only when a sufficient number of major interested parties perceive the need for change and participate in the elaboration of options which will preserve or enhance their interests." This has never been more true than in coastal Louisiana and the Delta areas around the world.

Second, like other large systems ... the Mississippi River is not a broken system. Yes, it's far from perfect and improvements and advancements must be made, regardless of your affiliation or perspective. But the Mississippi River Basin is a complex living system on a staggering scale, with incredible capacity to cause change, assimilate change, … such as the very real manifestations of climate change … , heal its self, and still deliver multiple essential services for the USA and global needs. And so it can for the delta regions and Coastal Louisiana.

Third, climate change is real. Across the Mississippi River Basin, we are experiencing fewer but more intense events. Based on 400,000 years of ice core data, CO2 concentrations have never been this high and it hasn't been this warm in about 125,000 years. The last time it was this warm, sea levels were about 23 feet higher than today. Climate adaptation is our new reality and Coastal Louisiana is a climate adaptation battle ground in the US, however, it won't be the last. Given the incredible ecological and economic implications for the USA, it is a crisis of national significance.

We have good infrastructure and institutional models in the Mississippi River watershed that can be built upon as the USA adapts. Looking back to the early days of the US, rivers were the transportation arteries or "interstate highways" of the day. At the Federal level and with the goal of interstate commerce and economic expansion, the U.S. Army Corps of Engineers was given the Federal role of improving select major rivers for navigation prior to the US Civil War (1863). As the Mississippi River basin gained population and began to develop, Flood Control emerged as an important political issue at the State and local level to help protect lives, property, and the developing economic activity.

But it wasn't until the destructive aftermath of the Great Flood of 1927 that the nation affirmed Federal interest in Flood Control through the Flood Control Act of 1928. That act adopted the Jadwin Plan, an early approach at a comprehensive plan for the entire lower valley of the Mississippi River below the Ohio River confluence. That plan has evolved into the current Mississippi River and Tributaries (MR&T) system, an integrated system of levees, spillways, floodways, reservoirs, and channel improvements that supports ecosystem services and navigation during low water, but allows the river to rise and expand laterally across the floodplain at higher flows, while also protecting communities and world renowned economic activity.

That integrated system, while under incredible duress and 87% complete at the time, successfully passed the Mississippi River flood of record in 2011 without catastrophic destruction or loss of life. The system worked as designed, protecting billions of dollars in economic activity. On the Upper Mississippi River (UMR), the Upper Mississippi River Restoration Program is allowing us and our partners to improve the UMR between St Louis, Missouri and St Paul, Minnesota benefitting over 100,000 acres of aquatic and floodplain habitat to date. It was the first program in the USA to combine ecosystem restoration with scientific monitoring and research efforts on a large river system.

It's important to note that the Flood Control Act of 1928 was not exclusively the product of the devastating flood in 1927. It was the product of ~ 50 years of multi-State technical, political, and institutional activism and agitation that accumulated sufficient momentum and political will to be expressed in the 1928 Flood Control Act as the Jadwin Plan. I believe that, through the efforts of current conveners in the USA … America's Wetland Foundation and America's Watershed Initiative and others, we are approaching a similar critical mass for Coastal Restoration in Louisiana, whether expressed as an expanded contemporary evolution of the Jadwin plan, a separate comprehensive coastal program, or other form.

From an institutional standpoint, persistent 19th century conflict and antagonism over competing visions of the future for the Mississippi River led to the establishment of the Mississippi River Commission (MRC) in 1879. The MRC is the only organization in the USA on record with a published greater watershed wide and challenge-able long term working vision. The vision was developed with decades of input by locals, stakeholders and partners (published in 2009). Throughout the decades, and again today, the MRC has requested and lead numerous important scientific investigations in the field of Potamology, or the integrated study of rivers. These resources and institutions will be integral in providing support and clarity for the development of the next steps of implementation for the vision for the Mississippi River.

Thank you for your work, your kind attention is most appreciated.

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Attachment: .PPT slides w/ MRC 200 yr working vision; Causes of coastal degradation; MS River Basin map; MR&T success in 2011; MRC Structure; Regulations

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