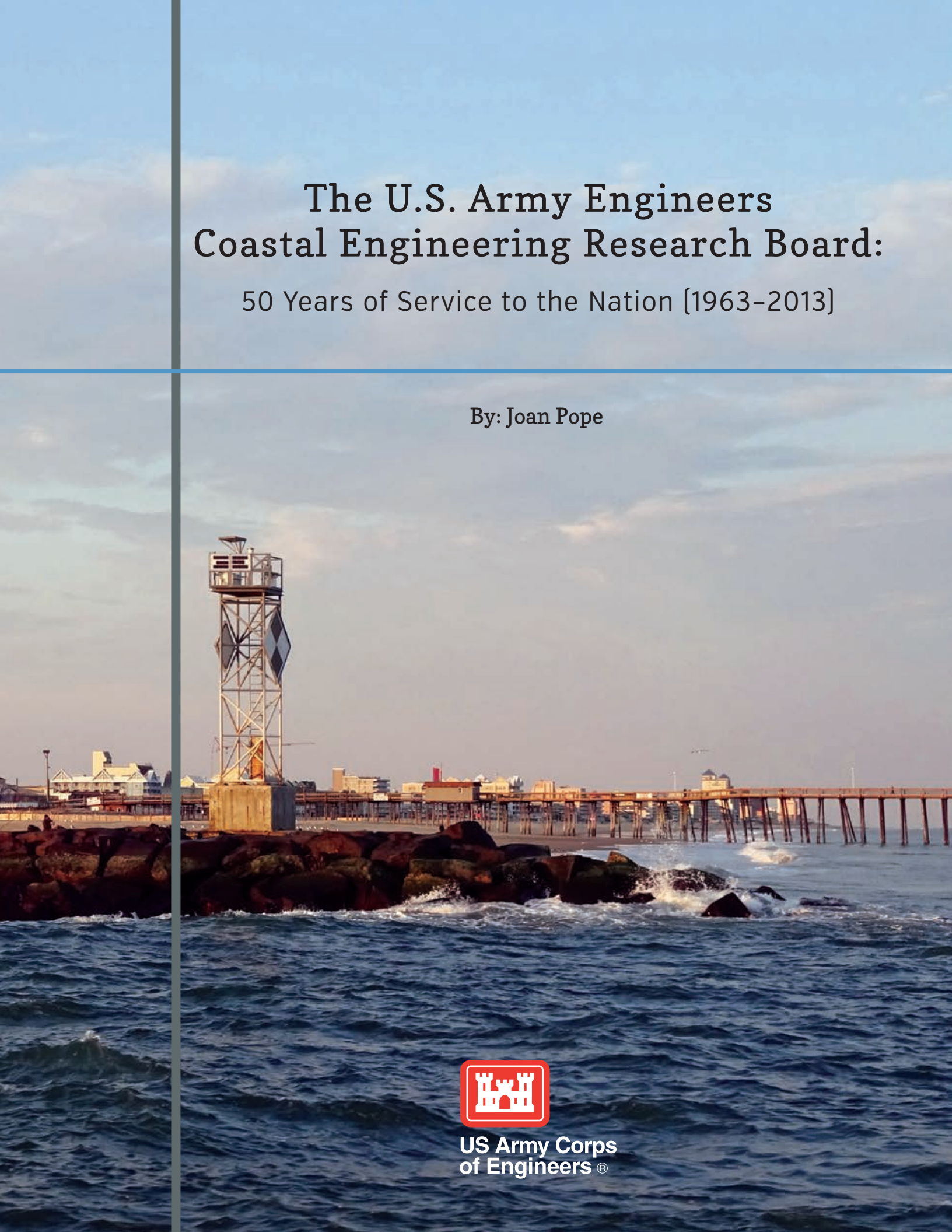
The U.S. Army Engineers Coastal Engineering Research Board:

50 Years of Service to the Nation (1963–2013)

By: Joan Pope



US Army Corps of Engineers ®

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U.S. Army Corps of Engineers

Office of History

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Front cover photo: view looking north from the South Jetty across Ocean City Inlet, Maryland

Back cover photo: view looking south along the nourished beach and seawall in Virginia Beach, Virginia

Delaware Indian River Inlet

Acknowledgements

Major General Michael J. Walsh, 24th President of the Board (2011–2013), directed the undertaking of an oral history review of the U.S. Army Corps of Engineers Coastal Engineering Board (CERB) in the spring of 2012. Dr. Jeffery P. Holland, former Director of the U.S. Army Engineer Research and Development Center (ERDC), U.S. Army Corps of Engineers (USACE); COL Kevin J. Wilson, former Commander of ERDC and Executive Secretary of the Board (2010–2013); Dr. William Martin, former Director of the Coastal and Hydraulics Laboratory (CHL) (2009–2013); Mr. José E. Sánchez, current Director of CHL; and Mr. W. Jeff Lillycrop, CHL and ERDC Technical Director for Civil Works Research and leader of the CERB's technical staff, facilitated the execution of this project.

Mr. Lillycrop was directly responsible for guiding this project from inception through completion. He also oversaw contracts with Moffatt and Nichol and with Information International Associates, Inc., which enabled the author to conduct this work. Dr. Matthew Pearcy, Headquarters, USACE Office of History, assisted in developing the interview strategy and in conducting several of the interviews. Dr. Pearcy also provided the author with important guidance and examples of various historical reviews. The Office of History provided the recording equipment that was used during each interview. Since 1985, Ms. Sharon L. Hanks, CHL, has managed the day-to-day logistics and operation of the CERB. It was through her generous assistance, first-hand knowledge, and her exemplary archives of all things CERB that this report was even possible.

Critical to the success of the CERB has been a number of unsung heroes who have not been mentioned in the body of this report. These include the various Division and District Commanders and their staffs who have hosted so many nearly flawless meetings. CERB meetings have always relied upon the dedication and professionalism of the various speakers and participants who have addressed the Board. Lead amongst the heroes are those individuals who, since 1963, have been responsible for the day-to-day tracking, logistics, and motivation of the CERB. Ms. Katherine (Katie) Rees (1963–1983) assisted Mr. Thorndike Saville with the CERB at the Coastal Engineering Research Center (CERC) in the District of Columbia and Fort Belvoir, VA. Ms. Harriet Hendrix (1983–1985) handled the CERB supporting Dr. Robert Whalin after the move of the CERC to Vicksburg, MS, in 1983. Since 1985, Ms. Hanks has continued this legacy through 2015, managing the budget, nomination packages, speaker tracking, briefing material, meeting coordination, and a thousand other invisible, but critical, tasks necessary to keep the CERB operating. She directly assisted Dr. James Houston, Mr. Thomas Richardson, Dr. Martin, and Mr. Sánchez as the Directors of the CERC and then the CHL as well as the Executive Secretaries of the CERB who were Commanders of the Waterways Experiment Station (WES) and then the ERDC. Ms. Tanita S. Warren currently continues this tradition.

Also acknowledged are those military and civilian CERB members whose perspectives and innovative thinking were responsible for not only the functioning of the Board but also caused it to flourish. It is through their knowledge and expertise that the Board has served as the catalyst for the many breakthrough concepts and initiatives that have improved the practice of coastal engineering, the mission and operation of the Corps of Engineers, and the Nation's coastal resources. Those Board members and CERB staff who provided the oral history interviews contained in this document represent a small subset of these leaders. The generosity,

knowledge, and perspective of those who willingly agreed to be interviewed for this project provided the very foundation of this report. Dr. Houston and Mr. Richardson graciously provided a technical review of this document. Ms. Sharon Hanks and Dr. Lyndell Z. Hales of CHL conducted a much appreciated factual and detailed review.

Finally, this report is dedicated to those coastal engineers and scientists of the Corps of Engineers laboratories, divisions, and districts who serve on the front line in professionally executing their craft to support technically sound and well conceived projects that maintain the Nation's coastal navigation, flood risk management, environmental restoration, and recreational opportunities. It is through them that the CERB's ideas and recommendations have been and continue to be implemented. Ms. Wendy L. Medlin, USACE St. Paul, prepared this publication ready document.

Author's Note

Since my graduate student days at the University of Rhode Island (1972–1976), I have been in awe of the CERC and the CERB. They were the ones doing the coolest stuff in coastal science. Their products, including the Shore Protection Manual, were central resources for many of my class papers. The civilian members of the CERB were the gods of coastal research and engineering. Working for the Corps of Engineers and doing coastal science was my dream job. In 1974 I was fortunate to be hired by the Buffalo District specifically to conduct sedimentation studies along the shores and watershed of Lakes Erie and Ontario. My section chief, Mr. Denton Clark, not only promoted innovative thinking but also looked toward the works of the masters for guidance. He helped me to see science and engineering as a continuum between knowledge and solutions and not as separate subject bins. In 1980, the Buffalo District had the great honor and terrifying charge to host a CERB meeting. This was the 34th meeting in Cleveland, OH, and Erie, PA (at Presque Isle). I presented the breakwater project at Lakeview Park, OH, and helped others in our section in the presentation of a dolos repair for the Cleveland Harbor breakwater and the Presque Isle breakwater and renourishment projects (Figure i). I particularly remember, after having given my presentation, going to the hotel restaurant for dinner and being invited by the three civilian members (Morrough P. O'Brien, Robert Dean, and Robert Wiegel) to join them as a fourth at their dinner table. They were so generous with their time, interested in my presentation, and enthusiastic about coastal issues that I was giddy for days. That dinner and the boyish excitement of these giants also gave me the confidence to push the traditional envelope, to recognize the Great Lakes as a wonderful laboratory for observing processes and testing solutions, and to document my findings in the professional literature.

Dr. Robert Whalin hired me in 1983 as he staffed the new CERC at WES. As a CERC researcher and later a Branch Chief, Division Chief, and Technical Director, I had the opportunity to present at and/or attend a number of CERB meetings and witnessed elements of the gradual transformation described in this report (at least over the last 35 years of the period covered in this analysis). I also had a chance to meet many of the individuals who were interviewed in preparing this report and others who have since passed away. In 2000, when Mr. Tom Richardson was promoted to Director of CHL, he asked me to take on the role of technical lead in coordinating CERB agendas and activities. That job included working closely with Corps Headquarters staff and leadership, the hosting Districts and Divisions, various presenters, and the CERB members. As each meeting came together, I was always amazed in how well the entire team worked together making each CERB meeting an "event." The civilian members were brilliant, kind, and always attentive to the presentations and subjects at hand. They would see the bigger issues and challenge presenters and attendees to think beyond the immediate. The military members brought a different perspective to the table. They needed to solve real world problems and do it within the context of a hundred other competing problems. I continued to coordinate CERB meetings until the 89th (2012) meeting when I retired from Federal Service as the Assistant Director for Civil Works Research and Development at the Headquarters of the U.S. Army Corps of Engineers.

I see the greatest value of the CERB as a forum for facilitating communication between Corps leadership and those doing the first-line work. A CERB meeting gives researchers, District practitioners, and partners from other agencies opportunities to explore issues from various perspectives as equal contributors to the discussion. Discussions during the breaks and at the end of the day are as valuable incubators of ideas and relationships as the formal presentations. Thoughts and ideas might be conceived during one CERB meeting but then be further nurtured between meetings by the technical staff and the members of the CERB themselves. Executive sessions and conference calls would help to push the topic along. At subsequent CERB meetings, that initial idea may continue to mature into recommendations for action. Through this process, a new area of research or a different way of doing business may be developed and change happens.

Bolsa Chica, California

Figure i. MG Elvin R. Heiberg III, President of the CERB (and Director of Civil Works) and the author at the Lakeview Park, OH project during the 34th CERB in April 1980. LTG Heiberg was Chief of Engineers of USACE from 1984 to 1988.

Introduction

The U.S. Army Coastal Engineering Research Board (CERB) was established on 7 November 1963 by Public Law No. 172, 88th Congress. This same act also abolished the Beach Erosion Board (BEB) (created in 1930) and established the Coastal Engineering Research Center (CERC). The CERB's mission was to function as an advisory board to the U.S. Army Corps of Engineers (USACE) Commander and provide advice and guidance to the CERC. The Board is a Federal Advisory Committee of the U.S. Army with its civilian members appointed by the Secretary of Defense. November 2013 marked CERB's 50 years of service to the Corps and the Nation. In recognition of this milestone, Major General Michael J. Walsh, the 24th President of the CERB (2011–2013), requested that oral histories be collected from past Board members and CERB senior leaders. This report presents those oral histories and provides a context for understanding the 50-year history of the Board.

In establishing the CERB, the Congressional committee specified that "the proposed Research Board is highly desirable.... The research functions are increasing in volume and importance. Such research functions would be retained and strengthened by the establishment of the Coastal Engineering Research Center, with guidance provided by a civilian board to furnish an element of continuity." (88th Congress, 1st Session, Senate Report No. 271 (19 June 1963)).

The Director of Civil Works, now Deputy Commanding General for Civil and Emergency Operations, serves as President of the Board. It also consists of three additional senior USACE officers who are commanders of coastal or Great Lakes divisions and three prominent civilians who are internationally recognized in the field of Coastal Engineering. From April 1964, when the first meeting was held at CERC, through September 2013, the CERB held 90 formal Board meetings. These meetings have been held throughout the country, visiting every United States coast including the Great Lakes and the Arctic Ocean. Over the first half-century history of the CERB, 23 distinguished civilian authorities have served on the Board; 24 Directors of Civil Works have served as President; and 83 Division Commanders have been members of the Board (includes several Commanders with multiple appointments). Currently, the Commander of the U.S. Army Engineer Research and Development Center (ERDC) serves as the Executive Secretary of the Board.

Nineteen oral history interviews were conducted between 26 April and 8 October 2013 with former CERB Executives (7), Civilian Board Members (7), Military Board Members and Board Presidents (5). The goal of each interview was to document their memories, experiences, and thoughts specifically in regard to their engagement with the CERB. The service of these individuals covers the first 50 years of the CERB's existence (1963–2013). Summaries of each interview are contained in Appendix A. A list of interviewees including their roles and periods of service relative to the CERB is documented in Table A-1. These interviews, supplemented by other published histories and unpublished records of past meetings that are archived at the offices of the Coastal and Hydraulics Laboratory (CHL) of ERDC, serve as the primary contribution to this 50th Anniversary Report. Appendix B lists all the previous members of the Board as well as the senior Board Staff/Executive Secretary. Appendix C lists the formal meetings of the CERB during this period as well as the themes for those meetings that were focused around a theme (after 1987).

Each interview covered that individual's career, activities, and impressions of the CERB, with the final questions focused on their thoughts regarding the impacts of the CERB to them, coastal engineering, and the Corps.

Each interview lasted about 1.5 to 2 hours and was recorded. The oral record can be accessed through the Corps of Engineers Office of History. The main focus of this report is an extraction from these interviews and both published and unpublished documents, to provide insight into the evolution of the CERB and the role of the CERB in influencing the USACE coastal related missions and the profession of coastal engineering.

Pre-CERB History of Coastal Engineering

There are several excellent publications that explore the detailed history of coastal engineering in the United States (Weigel and Saville, 1996 and the Coastal Engineering Manual, Part 1), the early engagement of the Corps of Engineers in coastal issues through the history of the Beach Erosion Board (Quinn, 1977), the history of the Waterways Experiment Station (Cotton, 1979 and Fatherree, 2004), the history of the U.S. Lake Survey (Woodford, 1991), and the research laboratory compliment to the CERB, the early years of the Coastal Engineering Research Center (Moore and Moore, 1991). The reader is referred to these reports for further background and greater depth on these topics.

The earliest significant coastal engineering work in the United States started in response to the Congressional River and Harbor Act of 1824 (26 May 1824) that authorized improvements to the Nation's navigation system. Several specific projects were authorized that would help to provide for safe harbor, commercial growth, and national security primarily along the eastern seaboard and into the Great Lakes. Over the years several harbor, port, and navigation improvements were authorized and constructed (e.g., Plymouth, MA; Lewes, DE; Erie, PA; Buffalo, NY). Constructing these works became the mission of the Corps of Engineers as the Nation's premier engineering organization. The guidance, engineering techniques, and basis for design were usually harvested from the European experience, supplemented by local engineering experience and site specific observational evidence.

Public/private interest in taking actions to control beach erosion started in the 1880s and 1890s, as groins, seawalls, and revetments were constructed by local interests to protect resorts and resort beaches along the New Jersey shore (Quinn, 1977). The New Jersey shore had become a popular summer escape from the crowded, sultry cities of New York, Philadelphia, Baltimore, and Washington. Early Federal involvement in shore protection was usually due to erosion in association with Federal navigation projects. One of the earliest examples is Presque Isle, Erie, PA, when storm-induced breaches in the barrier spit in 1828–1829, again in 1832–1833 and 1844, and, continuing into later years, threatened the integrity of the harbor at Erie. Federal funds were appropriated and action taken by the Corps, via fill placement, the use of twig and willow mats,

crib works filled with stones, and tree plantings throughout the mid-1800s to seal the breaches (Gorecki and Pope, 1993). The Great Galveston Hurricane of 8 September 1900 destroyed much of Galveston, TX, and killed an estimated 8,000 people. This event emphasized the need for both private and Federal action to protect vulnerable coastal communities from major coastal storms. The post-hurricane renovation of Galveston included substantial dredging and building of the land elevation as well as the construction of a massive seawall and revetment (1902–1905) that is a landmark project in developing the Nation's expertise in coastal engineering and construction (Weigel and Saville, 1996).

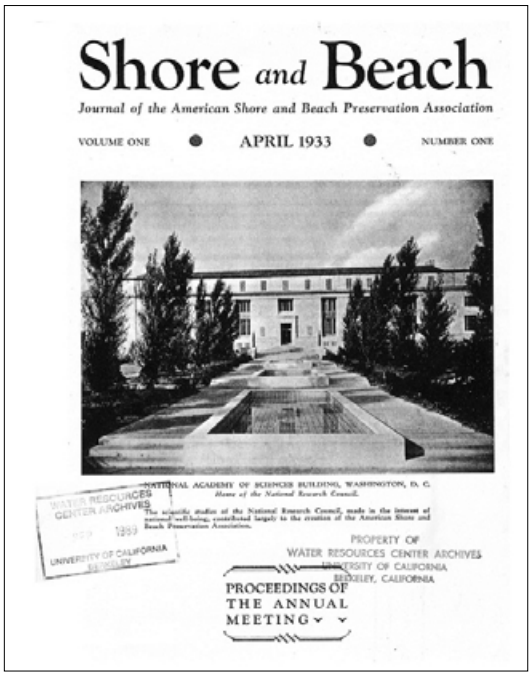
By the 1920s, between the advent of the automobile and the post-World War I euphoria, the beach tourism industry of the mid-Atlantic had become established. With increasing coastal development, damages associated with beach erosion became a concern to developers and government officials. The governor of New Jersey invited representatives from 16 states to a meeting on 14–15 October 1926 to discuss the issue. The National Research Council's Committee on Shoreline Studies was a sponsor of this meeting. A significant outcome of the meeting was recognition of the need for better scientific understanding of coastal and beach processes. From this and subsequent meetings at Norfolk, VA, and Washington, DC, by-laws were developed and the American Shore and Beach Preservation Association (ASBPA) was formed (8 Dec. 1926) (Kraus and Messing, 2001).

Partially through the work of the ASBPA as well as its own mission concerns (particularly related to navigation) with coastal problems, the Chief of the Corps of Engineers established a "Board on Sand Movement and Beach Erosion (BSMBE)" on 23 January 1929. The Board consisted of four USACE Officers and two appointed civilians as consultants. Thorndike Saville, who later served on the BEB and on the CERB, along with Douglas W. Johnson were the civilian science advisors and were responsible for developing a plan of coastal field studies. These studies, conducted between May 1929 and September 1930 near Far Rockaway, NY, and along the New Jersey shore included scientific observations and field experiments on coastal processes. The ASBPA continued to work with appropriate people in Washington, DC, and through their local state representatives (particularly in the state of New Jersey) to eventually result in Congress directing (3 July 1930) the USACE to form a Beach Erosion Board (BEB) (established in September 1930). Its mission went beyond the scientific observation function of the BSMBE to include investigation and studies with a view toward devising effective means of preventing coastal erosion. With the formation of the BEB, the BSMBE was abolished.

The BEB had seven appointed members, 4 military and 3 civilians, and was directed to conduct studies "devising effective means of preventing erosion…by waves and currents." The BEB built upon the initial work of the BSMBE and continued to oversee field studies, collect data, and publish findings. Initially, the BEB's role was to review, comment on, and approve plans for Federal coastal protects. Through cost-sharing studies with state agencies, the BEB oversaw field studies and increased its research activities resulting in a significant increase in the knowledge base of coastal engineering. Wave tanks were constructed in 1937 (at Fort Humphrey, VA, which later became Fort Belvoir) allowing for the growth of physical model experimentation and the development of the science of coastal hydrodynamics (Quinn, 1977).

With the Nation's costs associated with protecting coastal properties increasing, the Federal government and the Corps became interested in developing better scientific and technical understanding of coastal processes. During the 1930s and 1940s, the mission and manpower of the BEB expanded and included greater interest in conducting basic research. This expansion was a result of the 1930s public works boom and the need for

coastal situational information in support of allied activities during World War II. In 1945, Congress authorized the BEB to conduct general investigations and publish results where coastal erosion impacted on the public interest (no longer limited to Federal interest). This included work in all coastal areas of the United States including the Pacific, Atlantic, Gulf of Mexico, and Great Lakes. Concepts advanced through the work of the BEB included increasing the scientific foundations in the physics of wave form development and transformation, the concept of littoral cells and littoral sediment transport, the potential of sand bypassing, and the impacts of coastal structures on sediment transport (Quinn, 1977). In April 1933, the ASBPA started publishing its journal, *Shore and Beach* (Figure 1). This provided a vehicle for a significant increase in coastal and beach publications, many of which were prepared by Corps of Engineers officials. Early issues often included reports by District commanders on coastal projects in their areas, including articles concerning new navigation projects and the engineering design. There were also frequent articles on the activities of the BEB and overviews of the Corps coastal program by the Corps Director of Civil Works. Some of these early articles highlighted the significance of harbor structures and the associated channel dredging in modifying the coastline by inducing accretion on the updrift side and erosion on the downdrift side of the structures (Brooke, 1934). Kraus and Messing (2001) reviewed the development of *Shore and Beach* and referenced some of the pivotal articles including those by members of the BEB, CERB, and Corps officials.


Shore and Beach

Journal of the American Shore and Beach Preservation Association

VOLUME ONE ● APRIL 1933 ● NUMBER ONE

PROCEEDINGS OF THE ANNUAL MEETING

Figure 1. Cover page of the first issue of *Shore and Beach*.

In the 1940s, the BEB was moved to a facility on the Dalecarlia Reservation, Washington, DC. Its staff grew significantly as the expertise of coastal scientists and engineers became important in supporting military needs during World War II. Studies on landing craft performance under wave loadings, estimations of water depth, design of moveable breakwaters, and analysis of beach and nearshore characteristics for potential landing operation sites around the world were conducted in support of the war effort (Quinn, 1977). This work continued after the war and advances were made in several areas critical for civilian purposes such as the development of scientifically based wave forecasting and hindcasting procedures, advancement in measurement and monitoring technologies, and the development of design criteria for coastal and navigation structures. The BEB continued to have a major role in advancing coastal science and engineering and also became a central organization in developing nationwide data bases, monitoring networks, wave hindcasts, data resources, and conducting littoral transport studies at many different coastal settings. In 1954, the BEB published the first comprehensive coastal engineering guidance manual ("Shore Protection Planning and Design"), also known within the Corps of Engineers as Technical Report No. 4 (TR 4). It was revised several times by the BEB with the last revision in 1961. In 1973, the CERC superseded TR 4 with the "Shore Protection Manual" (SPM).

Establishment of the CERC and the CERB

Via Public Law 88-172 of the 88th Congress, S. 1523 dated 7 November 1963, the BEB was abolished and replaced by the Coastal Engineering Research Board (CERB) and the Coastal Engineering Research Center (CERC). As stated in the law, Section 2: "The functions of the Coastal Engineering Research Center…shall be conducted with the guidance and advice of a Board on Coastal Engineering Research, constituted by the Chief of Engineers in the same manner as the present Beach Erosion Board." The BEB's mission of reviewing reports of project investigations concerning erosion of the shores and protection of such shores was transferred to the Board of Engineers for Rivers and Harbors (BERH), previously established in 1902.

The CERC, as a Center, would operate directly under the Chief of Engineers and receive the bulk of its funding through a separate line item in the Corps budget. This gave the CERC direct access to the political process and in the early years (1960s through early 1970s), a healthy budget that supported expansion of its coastal research program (Moore and Moore, 1991). In the 1980s and 1990s, budget cuts, restructuring, and organizational changes had a negative impact on the CERC's base research program. However, the CERB played an important role in focusing Corps leadership's attention on its coastal mission and in identifying specific research challenge areas requiring funding.

The stated mission of the CERC was to conceive, plan, and conduct research in the field of coastal engineering to provide better understanding of shore processes, winds, waves, tides, surges, and currents as they applied to navigation improvements, flood and storm protection beach erosion control, and coastal engineering works. Originally the CERC occupied the BEB facilities at the Delecarlia Reservation but was moved (starting in May 1973) to Fort Belvoir, VA. The move into the newly constructed Kingman Building at Fort Belvoir was not completed until 2 years later (August 1975). Then, in 1983, CERC was moved to Vicksburg, MS, and onto the campus of the Waterways Experiment Station (WES) (Cotton, 1976). In October 1996, the CERC was merged with the WES Hydraulics Laboratory to form the Coastal and Hydraulics Laboratory (CHL) (Fatherree, 2004). At that time, the CERC no longer existed as a definable entity. However, the CERB continued and functioned by providing oversight and comment on the Corps Coastal Research and Development Program and advising Corps leadership on national trends pertinent to the Corps coastal-related missions. After the CERC was merged with the Hydraulics Laboratory, supportive management of the CERB became the responsibility of the Director of the newly formed CHL.

The CERB was created by Congress at the same time as the CERC as a means to retain the technical support of eminent civilian members from the BEB and as an advisory committee to the CERC. The CERB was designated as being composed of four USACE officers, three of whom would be Division Engineers whose geographic responsibilities included coastal areas and three civilian members prominent in the field of coastal engineering. The Director of Civil Works would be President of the Board and the CERC Commander would serve as the Executive Secretary. At the second CERB meeting (August 1964), the Board President (Major General Jackson Graham) stated that the CERB would review not only CERC's programs but also the coastal engineering portions of the programs at WES and at the U.S. Lake Survey. The CERB would then recommend priorities for accomplishing research projects across all the needs of the coastal engineering field as well as in support of the objectives of the Chief of Engineers.

As observed by Moore and Moore (1991) "…CERB could exercise a powerful influence over CERC. Some CERC directors would follow CERB's guidance, others would try to anticipate the board's wishes, and still others would try to use CERB to advance CERC interests. However, none would ignore it." This symbiotic dynamic between the CERB and the CERC and later the CHL is further revealed through the interviews conducted in support of this oral history review, particularly those with the CERB executive staff (Appendix A).

The organization and functions of the CERB were further codified by U.S. Army Corps of Engineers through Engineer Regulations. The most recent ER 10-1-16 dated 31 July 1992 reiterated the membership as; "…four senior officers of the USACE…and three prominent civilians who are internationally recognized in the field of coastal engineering, all appointed by the Commander." The CERB was directed to meet semiannually or at the call of the President of the Board; "to consider the coastal engineering research program of the USACE… provide broad policy guidance of plans and fund requirements for the conduct of research and development in the field of coastal engineering."…and to recommend "…to the Commander, USACE, overall priorities of broad research areas in consonance with the needs of the coastal engineering field and the objectives of the Commander."

Field Research Facility

Although the CERB and the CERC had long advocated the need for a permanent coastal field site for the acquisition of coastal data, the move of the CERC to Fort Belvoir, finding the right coastal location, and obtaining construction funds delayed the development of a field research facility for over 10 years. In August 1976, construction finally started on the USACE/CERC steel pier at Duck, NC, on the Outer Banks. The facility was dedicated on 29 August 1980, the 50th anniversary of the founding of the BEB. The "pier" (also known as the "Duck Pier") and the permanent research center officially called the Field Research Facility (FRF) was built to facilitate study of beach, surf, and nearshore processes on a continuing basis. These data provide a continuous, almost 40-year record of coastal hydrodynamics and morphological response as well as a test bed for shorter-term special studies. Several large-scale, multi-agency, international, and university study events have been held at the FRF, but it is the continuing data set that has provided valuable data for the advancement of wave theory, wave-current interaction, storm surges, sediment transport and numerical simulation technology made by both Corps and non-Corps researchers. The FRF includes a steel pier, an office building, an observation tower, classroom, electronics and mechanical shops, computer facilities, deployed instrumentation, sedimentation lab, and other equipment for data collection and instrument support (Birkemeier and Todd, 2001) (Figure 2).

Figure 2. Oblique aerial of the FRF at Duck, NC.

Corps Coastal Engineering Laboratories

There was often competition and, occasionally, some tension between the staff and organizations of the three Centers/Laboratories (CERC, WES, and the U.S. Lake Survey) responsible for conducting coastal research as their missions overlapped and they competed for funding. The CERB occasionally found itself in the unique position of sorting out these conflicts and developing recommendations on areas of responsibility and the potential for consolidation. Over the 50-year history of the CERB, it witnessed and usually had a role in several organizational consolidations.

The U.S. Lake Survey (originally established in 1841 in Buffalo, NY, to conduct hydrographic surveys in the Great Lakes) had over the years expanded its mission to include broad-ranging scientific research specific to the Great Lakes. In October 1970, President Richard Nixon established the National Oceanic and Atmospheric Administration (NOAA), and the majority of the Lake Survey was re-designated as the Lake Survey Center and transferred to NOAA. However, some of the functions of the old Lake Survey stayed with the Corps of Engineers, including the monitoring of Great Lake water levels which was transferred to the Detroit District, and the coastal research function (the Shore Processes Branch), which was transferred to CERC (Woodford, 1991).

More substantial were the conflicts between the Waterways Experiment Station's Hydraulic Laboratory, specifically its Wave Dynamic Division (WDD), and the CERC. The WES and WDD had advantages due to their significant physical model facilities and a strong foundation in applied research to address project needs. Primarily though research triggered by the Dredged Material Research Program and funding from the North Central Division (Great Lakes), the WDD significantly advanced the technology of developing numerical models to predict waves based on wind fields (Fatherree, 2004). Through this program, as well as military investments, the WDD invested in numerical modeling simulation technology ahead of the CERC. The CERC, however, had the advantage of being able to respond directly to the Office of the Chief of Engineers as the authorized center for coastal research and had a direct line of funding appropriations. While WES advanced concepts of numerical simulation and conducted cutting-edge research using state-of-the art physical models, CERC conducted more basic research on sediment transport and had a strong component oriented toward field data collection. Research activities and interests at CERC and WES often overlapped (Fatherree, 2004). The CERB reviewed the activities of both organizations, but through the 1960s and 1970s, its heart (particularly, civilian member Dean Morrough O'Brien) was with the CERC.

By the early 1980s, budget reforms brought to a head the difficulty in maintaining two research organizations dedicated to addressing similar problems.

"In a decision fraught with political infighting and intrigue, in February 1982 the Chief of Engineers endorsed a recommendation from the Corps' Directorate of Research and Development to relocate CERC to Vicksburg. Even before the decision was made public, Whalin (Dr. Robert Whalin) reported to Fort Belvoir in March 1982 to become CERC Technical Director. The move took place in 1983 only after vigorous protests from many CERC employees and intervention by most of the Virginia congressional delegation. Of the 83 CERC personnel offered transfers to WES, only 24 accepted; of those, two had been hired from WES in 1982 and one had been hired by CERC for transfer to WES." (Fatherree, 2004). The actual number of positions transferred from CERC at Fort Belvoir to WES is debatable (Dr. James Houston, personal communication). Part of the justification for the move was the elimination of positions. Redundant technical support,

administration, and information technology positions at CERC were not transferred, and a significant number of CERC engineering and scientific staff were not willing to make the move.

LTG E. R. "Vald" Heiberg III (1985), in addressing the CERB, publicly revisited his decision to move CERC to WES. He emphasized that it was the right decision and had proven to be a successful move in spite of the minuses he had to consider in making that decision. He also pointed out that he had discussed the issue "…with several former civilian members (of the CERB) before making that painful decision." In fact, the civilian members of the CERB specifically visited WES to gather information related to the proposed relocation of CERC to WES. This included significant touring of the facilities and dialogue with the staff (Dr. James Houston, personal communication).

Between 1983 and 1996, CERC grew and prospered first under the directorship of Dr. Robert Whalin (1982–1985) and then Dr. James Houston (reference their interviews in Appendix A). A young, enthusiastic staff was hired bringing CERC to a full complement of approximately 150 engineers and scientists backed by a highly capable and specialized technical team. Advanced test facilities were constructed including a spectral wave generator and a moveable bed basin. Additional investments were also made at the FRF. There was a dedicated field data acquisition program and personnel that led to advancements in instrumentation and data management. The greatest advancements were made in the area of computational systems. This included improvements in the science behind numerical simulations of hydrodynamics and sediment transport, the development of large system gridding technology, visualization tools, increasing speeds of computation, and the promotion of a computational product line that could be accessed and used directly by Corps field engineers and scientists.

Since the merging of the WES Hydraulics laboratory with the CERC in 1996, coastal-related research has been conducted through the consolidated Coastal and Hydraulics Laboratory (CHL). In addition to the work at CHL, coastal environmental research is currently conducted by the Environmental Laboratory co-located in Vicksburg, MS, and socio-economic and policy related research, including climate change, is conducted by the Institute of Water Resources (IWR) in Alexandria, VA. The CERB has engaged in reviewing coastal related activities from both laboratories. It has also engaged in reviews of selective coastal related work being conducted at the IWR and at various USACE Corps Districts.

Reporting on the CERB

During the 50 years between 1963 and 2013, the CERB was tied closely to the national interest in coastal engineering, the history of the CERC, and the evolving mission of the Corps. The CERB also evolved reflecting not only the interests and backgrounds of its membership but also external drivers such as the budgetary restructuring of the Corps coastal projects and research investments, the advent and growth of environmental concerns, breakthroughs in science and computational technology, regional mapping and analysis tools, and the occurrence of landmark coastal events (hurricanes and other significant storms, controversial coastal projects, and regional-based studies).

Appendix A contains summaries of each of the oral history interviews. Appendix B lists the civilian and military members of the Board as well as the CERB executive staff leads. Appendix C lists all the meetings of the CERB including locations and themes that were started in 1987. Over the 50 years covered by this report, the CERB has held 90 formal meetings. These meetings are chaired by the Director of Civil Works, now Deputy Commanding General for Civil and Emergency Operations, as the President of the Board, and the proceedings are documented in the early years via memorandums of records and in later years with a complete transcript. During this 50-year period, the CERB evolved from a small gathering that was engrossed in the details of a single research facility to large, interagency forums that considered the Corps mission, role, and the strategic directions relative to all coastal/ocean related functions. To illustrate this evolution, this report identifies four distinctive periods in history of the Board. The four periods are used as a convenient tool for discussion purposes. However, the actual evolution, it may be argued, was more gradual without distinctive horizons of change. These four periods are based on a review of the individual meetings as well as the comments of those individuals who were interviewed. Records of attendance, agenda, and minutes or proceedings were reviewed. The four periods also loosely align with changes in CERC and later CHL leadership reflecting the vision of the Corps' lead coastal scientist. The interpretation and characterization of these four periods is discussed later in this report but does inform much of the following discussion regarding the Board membership and meetings.

CERB Members and Staff (See Appendix B)

The CERB has had 24 presidents and 83 military members with several having served more than one term. There have been 23 civilian members; however, for the first 20 years of the CERB (1963–1983) there were only 5 civilian members whose terms were effectively indefinite: Thorndike Saville (1963–1969), Morrough P. O'Brien (1963–1980), Arthur Ippen (1963–1974), Robert Dean (1969–1981), and Robert Wiegel (1974–1985).

In October (6) 1972, Congress passed the "Federal Advisory Committee Act" (FACA) (Public Law 92-463), and the CERB became subject to this Law. FACA required open meetings, chartering, public involvement, and reporting. Thus, the CERB was required to submit reports every 2 years regarding Board membership, activities, duties, and a Charter to the Secretary of the Army. Until 1975, the Charter of the CERB did not state term limits. The 7 March 1975 Charter specified 6-year terms for civilian members. In response to guidance from the Department of the Army, the 1 October 1982 Charter changed the civilian term to 2 years, but there were no stated limits on renewals. The appointment of Willard Bascom in 1981 was the first shorter-term appointment, and he served 2 years plus one renewal, totaling 4 years. The current Charter dated 1 March 2013 states "Civilian Board members may be appointed by the Secretary of Defense or Deputy Secretary of Defense for a two-year term of service, with annual renewals; however, no civilian member, unless authorized by the Secretary of Defense, may serve more than two consecutive terms of service." In some cases an exception was requested and granted allowing civilian members to serve a third term. Examples are Doctors Robert Dean, Billy Edge, Joan Oltman-Shay, and Bruce Taylor. The longest continuously serving Board member was Morrough O'Brien who served 17 years. Dr. Dean (see Dr. Dean's interview in Appendix A) served 2 separate terms (12 + 6.5) totaling over 18 years.

Until 1985, the civilian Board members had all come from an engineering research background. In 1985, Dr. Dag Nummedal (Coastal Geologist) was appointed to the Board. He was followed by a 1988 appointment of Dr. Robert Reid (Oceanographer) and the 1992 appointment of Dr. Paul Komar (Coastal Geologist) (see Dr. Komar's interview in Appendix A). These, and subsequent appointments of scientists, expanded the Board's view to recognize the importance of a synergy between scientific foundations and engineering problem solving. Until approximately 2000, the civilian Board members had all come from academia. Thus the board had a strong commitment to fundamental research. However, starting with Dr. Oltman-Shay in 2001 and Dr. Taylor in 2002, the civilian membership included representatives from non-academic interests (private laboratories, other government agencies, and engineering consultant industry) (see Dr. Oltman-Shay and Dr. Taylor's interviews in Appendix A). This added a greater sensitivity in considering the practice, applications, collaboration, and implications of the research. During this 50-year period, only two women have served on the Board: Dr. Joan Oltman-Shay (2001–2007) and Ms. Margaret Davidson (2007–2012).

The military members of the Board were, with very few exceptions, either Brigadier or Major Generals. The exceptions were Colonels assigned as Division Commanders with the expectation of a relatively soon promotion in rank. The terms of the military members tended to be shorter than those of the civilian members. The military members were assigned to the Board by the Director of Civil Works (the Board President) based on their Command of a USACE Division with significant coastal responsibilities. When a Division Commander was reassigned to a non-Division role or to a Division without coastal responsibilities, they would cycle off of the Board. Thus the military members tended to be on the Board anywhere between 1 and 3 years. The exception is when a Division Commander's new assignment was another Division with coastal responsibilities.

They would then usually continue on the Board through their new assignment. An example is MG Todd Semonite who started on the Board in 2006 as the Commander of the North Atlantic Division (operating out of New York) and then was reassigned as the Commander of the South Atlantic Division (operating out of Atlanta, GA) in 2009 resulting in 6 continuous years of service on the Board (2006–2012). Another exception is when one of the Division Commanders on the Board became Director of Civil Works and therefore President of the Board. An example is MG Michael Walsh who was on the Board as the Commander of the South Atlantic Division (2004–2006) and was then President of the Board (2011–2013) resulting in 4 years of service to the Board (see MG Walsh's interview in Appendix A). The North Atlantic and the South Atlantic Division Commanders were almost always assigned to the CERB recognizing the large USACE coastal programs of the Atlantic and Gulf Coasts. The third member was usually from one of the Pacific coast or the Great Lakes Divisions.

The USACE Director for Civil Works (now Deputy Commanding General for Civil and Emergency Operations) serves as the President of the Board. There is at least one example where the Director of Civil Works assigned another General Officer as Board President. That was in 1986 when MG Henry Hatch assigned his then deputy (BG Patrick Kelly) responsibility for leading the CERB. Later, MG Hatch did take over as President of the CERB (1988–1991), and MG Kelly also became President a second time when he was promoted to Director of Civil Works (see BG Kelly's interview in Appendix A). The first six Presidents of the Board (through 1975) had not previously served on the Board as a military member. However, starting with MG Ernest Graves in 1975, many of the Board Presidents had previous experience on the Board as Division Commanders. Five of the Board Presidents continued in their careers to be appointed as Chief of Engineers (LTG John Morris (Chief 1976–1980), LTG Edgar Heiberg (Chief 1984–1988), LTG Henry Hatch (Chief 1988–1992), LTG Arthur Williams (Chief 1992–1996), and LTG Carl Strock (Chief 2004–2007). MG Merdith Temple served on the Board as North Atlantic Commander (2003–2005) and as President of the Board (2008–2010) and then served as Acting Chief of Engineers (2011–2012) (see MG Temple's interview in Appendix A). In addition, LTG Joseph Bratton, who served on the Board as the South Atlantic Division Commander (1979–1980), was appointed as Chief of Engineers (1980–1984) (Figure 3). During the 20-year period from 1976 to 1996, all of the Corps Chiefs of Engineers had served on the CERB and in several cases took a specific interest in the activities of the CERB providing a "Chief's Charge" to the Board.

The Executive Secretary for the CERB is a military position assigned to the Commander of CERC, and after the 1983 move of the CERC to Vicksburg, to the Commander of the Waterways Experiment Station and finally the Commander of the Engineering Research and Development Center. These individuals are listed in Appendix B. Although officially the responsibility of a Colonel or Lieutenant Colonel, usually the operational staff lead for the CERB became the responsibility of the civilian Technical Director of the CERC, and after 1996, the Director of the Coastal and Hydraulics Laboratory (CHL). The CERC Technical Directors were Joseph M. Caldwell (1963–1971), Thorndike Saville, Jr. (acting 1971–1973, 1973–1981), Robert Whalin (1982–1985), and James R. Houston (1985–1996). The CHL Directors were James R. Houston (1996–2000), Thomas Richardson (2000–2009) and William Martin (2009–2013) (see interviews for Saville, Whalin, Houston, and Richardson in Appendix A). Thus, the Corps research and development (R&D) coastal leaders interfaced directly with the CERB and assured that their staffs provided the day-to-day logistical support required to support the business of the CERB including addressing Action Items directed by the Board. In addition, the senior coastal point of contact at USACE Headquarters provided direct staff support

CERB USACE Chiefs of Engineers

Figure 3. USACE Chiefs of Engineers who have either been President of the CERB or served on the Board. Top row (L-R): LTG John W. Morris (1976–1980), LTG Joseph Bratton (1980–1984), and LTG Elvin R. Heiburg III (1984–1988). Second row (L-R): LTG Henry J. Hatch (1988–1992), LTG Arthur E. Williams (1992–1996), and LTG Carl A. Strock (2004–2007). Third row: MG Merdith W. B. Temple (Acting 2011–2012).

to the President of the Board. Key individuals fulfilling this role were Jacob Douma (1963–1979), John Housley (1970–1994), John Lockhart (1979–1997), and Charles Chesnutt (1994–2013, and continuing) (see interviews for Lockhart and Chesnutt in Appendix A). This collaboration between the R&D organization of the CERC and the CHL with the HQUSACE coastal lead provided the background staff support necessary to manage the CERB between meetings and to facilitate support during the meetings. Table A-1 lists individuals in these roles who were interviewed in compiling this Oral History.

Ocean City, Maryland Inlet

Chief's Charge

There are several cases where the Chief of Engineers has addressed the Board providing a "Charge" requesting the Board direct its energies toward a specific challenge of interest to the Chief. The first such charge was made at the November 1985 CERB meeting in Sausalito, CA, when LTG Heiberg requested the Board look at the need to develop "recommendations of specific approaches to solve coastal engineering challenges." He went on further to suggest the Board review what it had done in the past and its unique role in developing the field of coastal engineering, and then considering budgetary constraints, "…looking for opportunities…to find some significant funding sources, or help, for that role of coastal research and development from sources outside the Corps." LTG Heiberg stated, "…we in the Corps realize that we have a premiere responsibility for advancing coastal engineering technology not only in the U.S. but also across the world." In that context, he charged the Board to "do your best to provide specific fiscal and technical recommendations about long-term directions of coastal engineering." LTG Heiberg effectively asked the Board to start thinking bigger, nationally, strategically, and beyond the Corps toward the future of coastal engineering. In support of this vision, he also charged the Board to look for ways to develop a more solid base of coastal engineering talent within the Corps and to "grow our own professionals" (Heiberg, 1985). This charge in particular led to advances in cooperative training and educational programs through government university partnerships.

In December 1985, two Task Forces were set up, each consisting of military and civilian Board members as well as Headquarters USACE and WES/CERC staff to address LTG Heiberg's Charge. The first Task Force looked at innovative funding and projects with big payoffs. The second Task Force addressed research, education, and a national Laboratory as well the concept of a dredging research center (summarized in the following Table).

CERB Initiatives Developed in Response to the Charge from LTG Heiberg (1985)

Task Force 1:

Innovative Funding

- Work for other Federal Agencies
- Work for State or Local Governments
- Work for Private Industry
- National Science Foundation/Universities

Big Payoff Projects

- Dredging Research Program
- Dredged Material Mounds
- Surveying and Water Levels
- Field Data Collection Programs
- Operation and Maintenance
- Sedimentation Research
- Federal Coastal Commission

Task Force 2:

- National Laboratory Status
- Private Industry Use of CERC
- Dredging Research Facility
- National Coastal Laboratory
- Education and Training
- Basic/Applied/Fundamental Research

LTG Heiberg's Charge to the CERB and the recommendations of these Task Forces helped to define the vision that Dr. James Houston, as the newly appointed Director of CERC (1986), applied in shaping the next decade of CERC programs and initiatives. At the 56th meeting (June 1992) in Newport, OR, Dr. Houston presented the "Impacts of the Coastal Engineering Research Board," which emphasized the importance of the November 1985 Charge from LTG Heiberg and pointed out that "this charge began a new era of the CERB that continues today." In the late 1980s and 1990s, Dr. Houston oversaw CERC growth in sedimentation and dredged material mounds research, hydrodynamic numerical simulation technologies, the development of the Corps Bathymetric Lidar Mapping System (SHOALS), interagency and international data collection experiments at the FRF (e.g., SuperDuck and SandyDuck), the CERC/Texas A&M joint program to train master's level coastal engineers, the Dredged Research Program (DRP), the Coastal Inlets Research Program (CIRP), collaboration with the Army Research Office to fund basic research at universities, and the re-emergence of CERC as an internationally recognized center for coastal engineering research. Many of these advancements reflect directly back to LTG Heiberg's Charge and the subsequent energy infusion to CERC associated with its young, enthusiastic staff.

When LTG Arthur Williams addressed the 57th meeting of the CERB on 27 October 1992 in Honolulu, HI, he reiterated and reinforced the 1985 Charge of LTG Heiberg. LTG Williams recognized five areas of specific interest to him:

1. Education and Training (continue to "grow our own," expand on the Coastal Engineering Education Program with Texas A&M university to include more training opportunities across the Corps and in related disciplines).

2. Environment (develop holistic and comprehensive approaches to assure environmental sustainability, continue productive research between CERC and the WES Environmental Laboratory particularly in dredged material research, and look for other partnerships between environmental and coastal communities).

3. Technology Transfer (a two-way street including both the dissemination of information from the labs to the field and the field communicating its problems to the lab but also look at transferring technology and understandings to the wider public audience, including investments to develop a Coastal Engineering Manual as a replacement to the Shore Protection Manual).

4. Funding (traditional funding sources for R&D are declining, but the CERB is "…very instrumental in taking a broader more long-term view…", look at options such as cost-sharing, partnering, and joint ventures with other organizations, collaborate with district projects to acquire needed data, work with the National Science Foundation, build on past coastal military work to promote future military based research).

5. Programs (CERB should engage in Field Review Group meetings to understand the problems and constraints from our Districts, look toward our future needs and continue to "…give us a long-range, broad look at coastal engineering needs").

The third Chief's Charge to the Board was made by LTG Carl Strock on 4 November 2004 at the 78th meeting in Silver Spring, MD. This meeting and LTG Strock's Charge focused on the policy context that influences coastal research and engineering, particularly in light of the recent release of the U.S. Commission on Ocean Policy Report. "…we, as engineers and scientists, do have a role to play in influencing policy decision.…That is what this Board is all about, provides the science and the scientific and engineering underpinning of policy." In reviewing the Ocean Policy report, he recognized that the Corps is also an "ocean" agency with regional responsibilities that cross the watersheds and the littoral zones. LTG Strock was looking toward the CERB, IWR, and CHL to work together to assess current ocean missions, policies, and activities of the Corps and recommend a strategy for future Corps ocean activities and the steps needed, including research and partnerships. He promoted more Corps engagement with NOAA and in the Interagency Ocean Observation System (IOOS). LTG Strock's charge led to a broader policy and interagency collaborative focus for the CERB that impacted the agenda, membership, and initiatives of the CERB over the following decade.

The fourth and most recent Chief's Charge to the CERB was made on the 50th anniversary of the CERB (4 September 2013) by LTG Thomas Bostick at Long Branch, NJ. This meeting followed the late October 2012 Superstorm Hurricane Sandy that had devastated New Jersey and New York coastal communities and was the theme for this, the 90th CERB meeting. Reflecting upon the lessons from Hurricane Sandy, LTG Bostick's Charge was for the CERB to develop a strategy to enable the integration of risk reduction and resilience into Corps practices. Specifically, he challenged the Board to provide guidance on research outcomes that would provide the technical basis to quantify, predict, and manage risk reduction and increased resilience for coastal infrastructure. He directed the CERB to 1) engage in developing a definition of resilience in terms of the Corps mission; 2) look at how we measure, quantify, and predict resilience; 3) look at how resilience fits within the framework with our stakeholders and partners; and 4) how to manage resilience and still sustain the function of our water resources while also mitigating the risk associated with coastal hazards.

As is the case with the three previous Chief's Charges, LTG Bostick's Charge should also prompt the Board to develop forward thinking, strategic recommendations that help to position not only the Corps coastal engineering research program but also the Corps in addressing water resource challenges of the future. Each Charge has led to an evolution in the CERB, expansion of its footprint, and initiatives that have had far reaching impacts. These include expanding research into sedimentation, dredging and environmental areas; improvements in training, guidance and technology transfer; regional and system-based approaches; increased partnerships with other agencies; and emphasizing the symbiotic relationship between science and policy.

Meeting Locations, Themes, and Evolution (See Appendix C)

Between 1963 and 2013, the CERB has held 90 formal Board meetings. There were also additional meetings of just the civilian members or the Board in executive sessions. Originally, the formal meetings were held twice a year. However, starting in the mid-1980s, there were several years when budget constraints or scheduling conflicts resulted in only one meeting that year. Generally, the meeting locations have been at the Corps coastal research laboratories or at venues sponsored by a host Division and/or District. The locations have included sites on all four U.S. coastlines including Hawaii and Alaska (Figure 4). Since 2009, only one formal meeting and one executive Board meeting have been held each year. There is a distinctive evolution in the meetings over the 50-year period from a small meeting focused on the internal workings of a single research laboratory (CERC) to heavily attended interagency forums that cover major topics from various facets with implications across USACE and to the Nation. Based on interviews, documents, and the personal experience of the author, the following review traces that evolution.

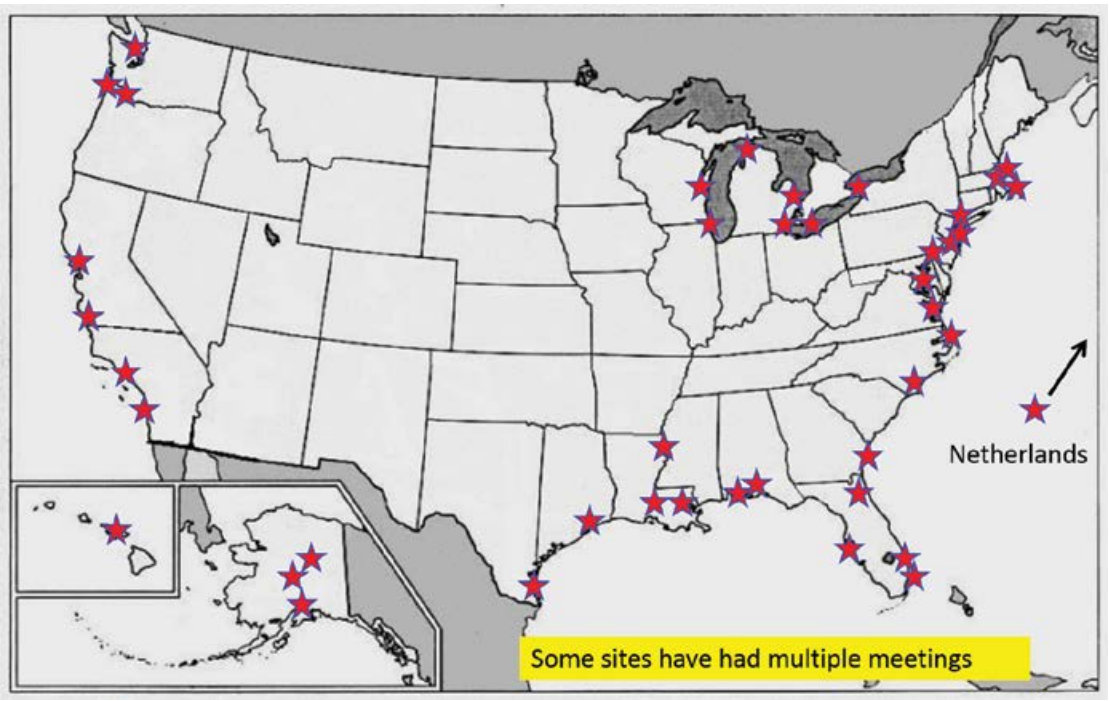


Figure 4. Locations of CERB meetings 1963–2013.

The Early Years (1963–1980)

The first meeting of the CERB was held 13–14 April 1964 at the facilities of the CERC. In addition to the seven Board members, others attending included representatives from the CERC, Waterways Experiment Station (WES), North Central Division, Lake Survey District (USLS), and the office of the Chief of Engineers. This was an organizational meeting that looked at the mission and authority of the CERB and included overviews of the three organizations involved in conducting coastal-related research activities (CERC, WES, and the Lake Survey). There were also discussions on executive issues such as CERC publication policy, staff, and funding as well as technical discussions regarding the state of the knowledge of coastal engineering.

From April 1964 through May 1967, the first eight meetings were all held at one of the three coastal research organizations and focused specifically on the operation and research programs of the CERC, WES, and USLS. These meetings were attended only by the Board members and USACE personnel from Corps Headquarters and occasionally a Division, and from the three coastal research laboratories, plus the Committee on Tidal Hydraulics (CTH). An exception was the 8th meeting (May 1967) which included two CERC contractors, one of whom was the renowned sedimentation scientist, Hans A. Einstein. These early meetings were focused on the details of the research and the internal organization structure of CERC and the other laboratories. The Board members would delve into technical details of various research activities, the design of the facilities, personnel actions, the placement of field instruments, a review of the budget, and were even engaged in reviewing publications.

The 9th meeting (Oct. 1967) was hosted by the USLS and the North Central Division (NCD) and is notable as the first meeting not held at a coastal lab (although the USLS was the host for the meeting). The focus of this meeting was, as had been the previous meetings, heavily dominated by discussions regarding CERC facilities and research program, but included reviews of some Great Lakes specific projects and for the first time a field inspection trip (Chicago, IL waterfront). Another notable aspect from this meeting was a discussion of the recommendation to "Prepare a new program of Regional Studies in Cooperation with Universities, States, and/or Corps Districts." The 10th meeting (May 1968) was held in the Palm Beach/Miami Beach area of Florida and continued the trend of broadening the interests of the CERB to include a field inspection of coastal projects, and participation by USACE Division and District personnel as well, as where appropriate, presentations by the research contractors on the work they had conducted. The CERB was specifically invited by the South Pacific Division (SPD) Commander to meet in southern California for the 11th meeting (Oct. 1968). This meeting included a two full-day field inspection trip plus presentations by CERC and WES, several contractors (including Dr. Bernard LeMehauté and Dr. Fredric Raichlen, both of whom would later serve on the Board), and presentations by Los Angeles District engineers on various projects. No longer were the meetings restricted to reviews of coastal research programs.

The 12th meeting (July 1969) returned to CERC and included several revolutionary agenda topics including development of a coastal ecological program, a coastal research program for Alaska, research on dune stabilization on the Texas Coast, and studies for a proposed CERC research pier. There was also a presentation by the Baltimore District (NAB) Commander on Chesapeake Bay Shoreline Program. The model for future CERB meetings had been established: held at coastal locations, limited participation, hosted by a Corps Division and District, a field inspection trip (often including an over flight), and some presentations on local coastal projects and/or other issues of interest to the Board.

The 13th (Oct. 1969) through 22nd (Mar. 1974) meetings alternated between meetings at a laboratory (either CERC or WES) and meetings at a District venue. The 13th meeting was at Corpus Christi and Galveston, TX, and held only 2 months after landfall of Hurricane Camille (August 17, 1969) in Mississippi. Presentations from the South Atlantic Division (SAD) were on the agenda as well as discussions on Galveston storm surge studies. The Generalized Inlet Study (later called the General Investigation of Tidal Inlets (GITI)) program was underway and both the 14th and the 16th meeting held at WES dedicated portions of the meeting to discuss the physical model facilities built to support this research program. The 15th meeting (Oct. 1970) held at the Massachusetts Institute of Technology (MIT) was hosted by civilian Board member Dr.

Arthur Ippen and the New England Division. It included a number of MIT researchers in addition to the Board and Corps personnel. Presentations were given by both WES and CERC on the GITI and the research activities occurring at each laboratory. Previous meetings had included discussions during the Executive Sessions regarding a future update to TR 4 (Shore Protection, Planning, and Design). The CERB commented on several occasions that they would prefer to see CERC develop the next document more as a manual and less as a handbook. This is the first meeting where a TR-X, (what would eventually be known as the Shore Protection Manual) is discussed with a proposed outline as the next generation guidance document to replace TR-4. This meeting was also notable as the first meeting since the October 1970 Presidential reorganization directive that transferred most of the U.S. Lake Survey District personnel and functions to the NOAA and the Shore Processes mission and personnel to CERC.

The 17th meeting (Oct. 1971) held at CERC was a joint meeting with the USACE Committee on Tidal Hydraulics (CTH). The CTH was formed in 1948 and had previously held 73 meetings. It provides consulting services within the Corps, conducts its own research, and releases publications. The 19th meeting in Jacksonville District (Oct. 1972) included the first presentation by another federal agency as USGS was represented and discussed mathematical modeling of Tampa Bay. The 20th meeting at CERC (May 1973) was very much engaged in the development and review of the Shore Protection Manual (SPM) and with plans for developing a Field Research Facility (Figure 5).

The 22nd meeting (Mar. 1974) was the first meeting at the new Fort Belvoir venue of CERC, although the office and laboratory facilities were still under construction. The Field Research Facility was planned for construction at Duck, NC, the SPM was to be published in July, and two major research programs (the GITI and the Dredged Material Research Program (DMRP)) were hot topics of the meeting. Meetings at the lab venues were structured around technical presentations by researchers or representatives from Corps Headquarters followed by closed Executive Sessions that would often delve into specific issues related to the budget and develop research recommendations. Meetings at District and Division venues split the technical part of the program between presentations by researchers and District/ Division representatives and field trips, again followed by closed Executive Sessions. The field trips were often complex affairs involving plane or helicopter overflights, bus and boat tours, even dune buggy rides, and visits to multiple projects. Participation was limited to the Board, key representatives from CERC, WES, Corps Headquarters, and the local District/Division.

Figure 5. 20th CERB, Coastal Engineering Research Center. L-R: Dr. Robert G. Dean (Univ. of Florida), BG Ernest Graves, Jr. (Cmdr. NCD), Dean Morrough P. O'Brien (Univ. of California), LTC D.S. McCoy (Executive Secretary of the CERB), MG John W. Morris (President, HQUSACE), MG D.A. Raymond (Cmdr. SAD), Dr. Arthur T. Ippen (MIT), and BG George B. Fink (Cmdr. SPD).

Starting with the 23rd meeting in Wilmington, NC (Sep. 1974), most meetings were hosted by Divisions or Districts at a coastal region or project area of interest. Only the 26th meeting (May 1976) returned to CERC at the new Fort Belvoir, Kingman Building location. Only the 37th (Nov. 1981), the 46th (Oct. 1986), the 60th (Nov. 1994), and the 81st (July 2006) returned to the WES/ERDC laboratory complex at Vicksburg, MS, although the 74th (Sep. 2002) meeting was held at the Field Research Facility at Duck, NC. Thus, after the first 10 years of its existence, there was a significant change in focus as the Board became less involved in reviewing the internal operations and details of the coastal lab programs and more concerned with the research requirements driven by the Corps Districts and project needs. Occasionally, the civilian Board members would meet at the labs for a more in-depth review of the research program, but these were informal affairs and became less frequent in later years. Regardless of the meeting location, there were usually presentations on the agenda by CERC, WES, or CHL researchers on research activities of specific interest to the Board. As an example, at the 25th meeting (Dec. 1975) in San Diego, CA, a presentation was made by Dr. Donald T. Resio of WES on the Wave Information Program for the Great Lakes. This presentation introduced a new capability, based on numerical simulation to develop a hindcast wave climatology that would eventually be expanded to all coasts of the United States and become known as the Wave Information System (WIS).

As the Board became more engaged in Division and District projects and in observing coastal issues at various locations, they also began to formally solicit research needs and identify coastal problems from the perspective of Corps practitioners. The 25th meeting in San Diego, CA (Dec. 1975), included such a presentation by Mr. Orville T. Magoon of SPD. When the CERB returned to CERC at Fort Belvoir (May 1976) for the 26th meeting, a representative from each Corps Division with a coastal mission participated, and there were presentations on the research needs of each Division. The 28th meeting in New York (June 1977) included not only a representative from each coastal Division but also numerous representatives from two of the local Districts and totaled over 50 participants. As previous meetings ranged from 20 to 40 participants, the 28th meeting was the most attended meeting during the first 15 years of the CERB.

The 29th meeting in Wilmington, NC (Oct. 1977), again included representatives from other coastal Divisions as well as from two of the SAD Districts, but is most notable in that there were five non-Corps guests. Previous meetings had occasionally included attendance by one or two non-Corps guests, but most meetings were comprised of only Corps personnel. The 30th meeting in Corpus Christi, TX (Apr. 1978), included six guests including Congressman John Young of Texas who also addressed the Board. There were eight guests at the 31st meeting in San Francisco, CA (Oct. 1978), and thus the trend was in place to invite local interested academics, government officials, and authorities, particularly if they had involvement or interest in projects that were either on the agenda or that they had a role in presenting.

The 34th meeting held in Cleveland, OH, and Erie, PA (Apr./May 1980), was typical of the model that had developed for the CERB meetings but also marked some important changes. The participation was approximately 40 people, with three non-Corps guests and representatives from other Divisions. The meeting included visits and presentations on various District projects (in this case Buffalo District (NAB)), presentations by CERC on their R&D program, a discussion by NCD on research needs, and status reports on several ongoing coastal programs. The Board then provided recommendations. This meeting is also notable as it included a dinner speech by Dr. Orrin Pilkey, who was a geology professor from Duke University and had been very much at the forefront of promoting the position of abandoning the coast. His remarks prompted

some fiery exchanges with the civilian members of the Board. This was also the last meeting attended by Dean Morrough P. O'Brien as a member of the Board. When he retired from the Board, Dean O'Brien had not only been the longest serving member of the Board (17 years) but had actually started his career conducting experiments for the BSMBE in 1930 and had served on the BEB from 1938 to 1963. During his nearly 50 years of service to the Corps coastal engineering program, he had a significant hand in shaping the CERB and the coastal engineering profession.

The Transition Years (1980–1987)

Between 1980 and 1987, CERC at Fort Belvoir was closed and transferred to join the WES in Vicksburg, MS. The recommendation to relocate CERC to Vicksburg was approved by the Chief of Engineers in February 1982, and the move occurred in 1983. The CERB had an important role in developing and endorsing this recommendation. MG Heiberg, as Director of Civil Works and as President of the CERB, requested that members of the Board provide him with their analysis of the situation. With budget consolidations, the overlapping functions of the Wave Dynamics Division at Vicksburg and of CERC at Fort Belvoir, there evolved a situation needing reform. It is no accident that the last meeting before the move was decided and announced was the 37th meeting (Nov. 1981) held in Vicksburg. This was a joint meeting sponsored by WES and the Lower Mississippi Valley Division (LMVD) and included an extensive review of the physical model facilities and projects at WES as well as a tour of Louisiana coastal areas and flood management projects. Dr. Robert Whalin, formally Chief of the Wave Dynamics Division at WES, was appointed as Director of CERC in May 1982, replacing the retiring Thorndike Saville, Jr. (see interviews in Appendix A). Dr. Whalin oversaw the transfer of CERC to Vicksburg, its merger with the Wave Dynamics Division, and multiple hiring actions as CERC's staff was rebuilt. Only 24 CERC personnel accepted transfers to WES (Fatherree, 2004). Dr. Whalin served as the Director of CERC until 1985 when he was promoted to Director of WES.

The 35th meeting (Nov. 1980) in Baltimore included participation from the various Divisions and also each District located within the North Atlantic Division (NAD). This meeting included presentations on ice effects and a visit to the Chesapeake Bay model. NAD presented its coastal research needs. The 36th meeting (Mar. 1981) in Galveston was the last meeting attended by Mr. Thorndike Saville, Jr., who had retired as Director of CERC in January. The meeting included a presentation on the planned collaborative and interagency Atlantic Remote Sensing Land-Ocean Experiment (ARSLOE) at the FRF. The 37th meeting (Nov. 1981) was hosted by the Lower Mississippi Valley Division and WES in Vicksburg, MS. Only two civilian members attended, Mr. Willard Bascom who was newly appointed to the Board replacing Dean O'Brien and Professor Robert Weigel (1974–1985) who was the last of the original block of members. The 38th meeting (Apr. 1982) in San Diego, CA, was a very well attended meeting that included the senior staff of Headquarters USACE Directorate of Research and Development (the organization responsible for developing the recommendation to move CERC to Vicksburg) and from WES but a much smaller than usual contingency from CERC (Figure 6). Dr. James Choromokos, USACE Director of R&D, announced that CERC would move to Vicksburg during "this" fiscal year. He stated that a news release had just come out announcing the move and that 98 CERC positions would be transferred to WES. Further, he stated that Dr. Robert Whalin had been selected to replace Thorndike Saville, Jr., as the new Technical Director of CERC. The permanent order changing the location of CERC to Vicksburg was effective 1 July 1983.

Figure 6. 38th CERB, 13–15 April 1982, San Diego, CA. Front row L-R: COL Ted E. Bishop (Executive Secretary of the CERB), BG James W. van Loben Sels (Cmdr. NPD), COL James E. Edgar III (Cmdr. NED). Back row L-R: MG E.R. Heiberg III (President HQUSACE), Prof. Robert L. Wiegel (Univ. of California), BG Hugh G. Robinson (Cmdr. SWD), and Mr. Willard Bascom (Southern California Coastal Water Research Project).

The 39th meeting (May 1983) in Wilmington, NC, is notable as the first meeting after the move of CERC to Vicksburg had been initiated. Dr. Whalin's former boss and mentor, Dr. Bernard LeMehauté, was the newest civilian member of the Board. This brought the civilian membership back to three for the first time since 1980. This meeting also reflected the changing laboratory relationships as WES's historic interest in both dredging and environmental-related research now had a more commanding role on the agenda. SAD presented its research needs, and separate field trips were structured for the Board and for the other attendees. As CERC was just rebuilding its organization in Vicksburg, no meeting was held in the fall of 1983.

The 40th meeting (Oct. 1983) in North Falmouth, MA, through the 69th meeting (Apr. 1999) were documented in formal Proceedings published by WES. For the first few years each author submitted an abstract and a technical paper of their presentations. These were supplemented in published Proceedings by verbatim questions and answers from the meeting. The result was a fairly significant document. The Proceedings from the 43rd meeting totaled over 500 pages. After the 44th meeting, they became more modest publications limited to an abstract and abbreviated paper. Prior to the 40th meeting, each meeting was documented in an unpublished USACE memorandum that paraphrased the meeting discussions. Meetings after the 69th meeting have recorded transcripts.

The 40th meeting was sponsored by the New England Division (NED) and reflected Dr. Whalin's expanding vision of the CERB both in terms of participation (84 attendees) and in the scope of the agenda. Attendees included not only those from the laboratories, Corps Headquarters and each Division but also non-Corps representatives from several universities, NOAA, and state governments. Numerous presentations were given by

district personnel as well as presentations by representatives from the state governments. Presentations on the R&D program were either general programmatic overviews or spotlighted specific high-profile research projects. The civilian members had a separate meeting in August 1983 with the researchers to go through research specific presentations, and the intention was to conduct these comprehensive technical reviews annually. In his remarks regarding the relocation of CERC, COL Tilford Creel (Commander of WES and Executive Secretary of the CERB 1983–1985) stated that approximately 50 percent of the CERC staff moved and that there had been a "…rapid hiring of practically a full complement of personnel…."

The 41st meeting (June 1984) in Seattle, WA, again included at least one representative from each Division as well as a number from local universities totaling over 60 attendees (Figure 7). There were presentations from each coastal district within the North Pacific Division (NPD) and also some higher-profile research activities focused on the north west coast. The 42nd meeting (Dec. 1984) in Chicago suffered from scheduling conflicts, and due to winter weather, had a modified field excursion (including a visit to a steel plant). Each District in the NCD made presentations, and the State of Illinois was included in the agenda. The 43rd meeting (May 1985) returned to WES at Vicksburg. This meeting included reviews by Headquarters functional elements on various HQ programs and presentations by CERC program managers on each major research area program. LMVD presented its research needs. Mr. William Murden, Chief of the Dredging Division at the USACE Water Resources Support Center (WRSC), pleaded for more dredged material research including the topic of nearshore berms and dredged material mounds. This presentation eventually lead to a major demonstration project off of Mobile, AL, and subsequent research on the use of nearshore berms to enhance coastal beaches by wave attenuation and the cycling of beach quality sand onto the beach, and offshore "stable" mounds as a dredged material disposal option.

Figure 7. 41st CERB, 5–7 June 1984, Seattle, WA. L-R: BG Thomas E. Sands (Cmdr. NAD), COL Tilford C. Creel (Executive Secretary of the CERB), Mr. Willard Bascom (Southern California Coastal Water Research Project), BG James W. van Loben Sels (Cmdr. NPD), BG Robert J. Dacey (Cmdr. SWD), BG C.E. Edgar III (President, HQUSACE), Dr. Bernard LeMehaute (Univ. of Miami Rosenstiel School of Marine and Atmospheric Sciences), and Prof. Robert L. Wiegel (Univ. of California).

The 44th meeting (Nov. 1985) at Sausalito, CA, was hosted by SPD. Professor Robert Weigel had retired from the Board, and two new civilian members, Dr. Chiang Chung Mei and Dr. Dag Nummedal had joined the Board. Dr. Robert Whalin had been promoted to Technical Director of WES while the new Director CERC was yet to be named. It is at this meeting that LTG E. R. Heiberg presented his "Chief's Charge" to the CERB. The visionary challenges presented by LTG Heiberg fell to a relatively new Board with a new President (BG Patrick Kelly) and as yet unidentified new Director of CERC. There was great enthusiasm and a developing new focus of the CERB to follow. The 45th meeting (May 1986) in Fairbanks and Homer, AK, was hosted by NPD (Figure 8). Due to travel expense and the remoteness of this meeting, attendance was more limited than that of recent meetings. However, this is the first meeting with Dr. James Houston as the new Director of CERC. The 47th meeting (May 1987) at Corpus Christi, TX, was presided over by MG Henry Hatch as the new President of the Board. This is the meeting where MG Hatch famously remarked that the practice of having separate field trips with coastal flyovers and interesting commentary for the Board members, while the Board "guests" had long bus trips viewing dredged material disposal sites, should be reevaluated. Subsequently, the field trips were a little less grand for the Board members but still focused on coastal processes and features of local interest.

Figure 8. 45th CERB, 9–16 May 1986, Fairbanks and Homer, AK. L-R: BG Patrick J. Kelly (President HQUSACE), Dr. Dag Nummendal (Louisiana State University), BG (P) George R. Robinson (Cmdr. NPD), Dr. Bernard J. LeMehaute (Univ. of Miami Rosenstiel School of Marine and Atmospheric Sciences), CO Allen F. Grum (Executive Secretary of the CERB), and Dr. Chiang Chung (C.C.) Mei (MIT).

The CERB went through a dramatic makeover during the 7 years between 1980 and 1987 reflecting changes in the Corps R&D funding structure and a new CERC organizational culture. The CERC in Vicksburg took on a new, younger, more aggressive personality that worked across disciplines, invested in developing numerical modeling capabilities, and engaged more in applied projects in support of Districts. The Field Research Facility (FRF) became a major player in attracting international and interagency interest to the Corps capabilities. Field Review Groups (FRG) were formed representing the Corps Division and District customers. These FRGs became a major voice in reviewing and helping to prioritize the research program. The CERB no longer focused on internal details of the Corps coastal engineering research program. The CERB became more critical in advising Corps Headquarters and the Corps military leadership on coastal issues and in facilitating coastal technology transfer to Corps field offices.

The Theme Years (1987–1998)

The 48th meeting (Nov. 1987) in Savannah, GA, was the largest CERB meeting to date including over 110 participants of which approximately 30 were non-Corps guests or visitors. This was the first meeting to be built around a theme, a practice that would continue for the next 25 years. The 48th meeting theme was "Sea Level Rise." A panel of non-USACE experts was assembled to address the predicted magnitude of sea level rise, and others discussed the implications and appropriate reactions. The 49th meeting (May 1988) in Oconomowoc, WS, built on the previous meeting theme by addressing "Coastal Engineering Implications of Changes in the Great Lakes Water Levels." Challenges caused by fluctuating lake water levels along with engineering adaptations were discussed. The meeting ended with a panel discussion by several academics on Great Lakes coastal R&D. Guests included representatives from various state and local governments, universities, engineering firms, other Federal agencies, and the International Joint Commission (IJC) (USA and Canada Treaty organization for coordinating boundary waters quality and quantity issues).

The 50th meeting (Nov. 1988) in Virginia Beach was structured around the theme of "Long-Range Research Needs in Coastal Engineering." Typical of the theme meetings, the first part of this meeting was focused on local interest projects (in this case coastal concerns of the Norfolk-Virginia Beach area) while the latter half of the meeting addressed the theme through various panels that considered research needs in hydrodynamics, sediment transport, instrumentation, facilities, and structure design. The CERB meetings had become significant coastal and local project events with over 130 people attending the 50th meeting. The 51st meeting (May 1989) in Wilmington, NC, had the theme "Shoreline Erosion and Restoration." Presentations focused on the effects of seawalls and other coastal structures on beaches, beach fill performance and design, alternative forms of shore protection, numerical modeling tools, and policy.

The 52nd meeting (Oct. 1989) was held at Redondo Beach, CA, with the theme "Pacific Coastal and Navigation Challenges." Presentations were given by the Mayor of Oceanside, CA, representatives of Surfrider, and the Ports of Los Angeles and Long Beach. The theme meetings usually focused on issues from various vantages and less on research or technology detail. There would often be updates on high-visibility research programs and presentations on reimbursable projects that CERC was performing that were germane to the meeting locality. The 53rd meeting (June 1990) was in Fort Lauderdale, FL, with the theme "Coastal Inlets." The mandate to develop what eventually became known as the Coastal Inlets Research Program (CIRP) was a direct outcome from this meeting. The 54th meeting (June 1991) in New Orleans, LA, had the theme of

"Coastal Flood Protection." The meeting included several presentations on dredged material research, near-shore berms, and wetland research, but the focus was on coastal land loss and flooding along the Gulf Coast. Presentations on hurricane modeling and research needs was a major topic (fueled by Hurricane Hugo, which had impacted the South Carolina coast in Sep. 1989).

The 55th meeting (Oct./Nov. 1991) had the misfortune to be held in Mashpee, MA (on Cape Cod), at the same time that the New England coast was being battered by an extreme extratropical storm that became known as the "Halloween Storm of 1991" or the "Perfect Storm" later immortalized in a book and a movie by the same name (Figure 9). The theme was "Dredging" with presentations on the Mobile, AL, dredged material berm demonstrations, dredging policy, and an introduction to the new CIRP. However, many attendees remember the meeting for the hurricane force winds experienced during the field trip. The 56th meeting (June 1992) was held in Newport, OR, with the theme "Coastal Structures." This meeting included a presentation by Dr. James Houston, Director of CERC, on the "Impacts of the Coastal Engineering Research Board." He emphasized many of the initiatives that had come out of LTG Heiberg's Charge at the 44th (Nov. 1985) and how important this Charge and the Board's follow-on activities have been in promoting many advancements at the CERB and in the arena of coastal engineering. This meeting also included presentations on the new CIRP.

Figure 9. 55th CERB, 30 Oct.–1 Nov. 1991, Mashpee, MA. L-R: MG John Sobke (Cmdr. SAD), Dr. Fredric Raichlen (CalTech), BG Stanley G. Genega (Cmdr. SWD), Prof. Robert A. (Tony) Dalrymple (Univ. of Delaware), BG Roger F. Yankoupe (Cmdr. SAD), Prof. Robert O. Reid (Texas A&M), and MG Arthur E. Williams (President HQUSACE).

The 57th meeting (Oct. 1992) was held in Honolulu, HI, with the theme "Pacific Islands Coastal Engineering." This was the meeting where LTG Arthur Williams presented the second Chief's Charge to the Board. The meeting was also notable due to a large participation from the Hawaiian Islands. The Corps Pacific Ocean Division (POD) was represented by 35 employees while there 43 guest participants and guests from universities, governments (federal, state, and local), industry (ports, consultants, engineering firms, etc.), and non-government organizations. The 58th meeting (June 1993) was in Atlantic City, NJ, with the theme "Coastal Data Collection." Large portions of the agenda focused on data needs from both the national and NAD perspective, the Corps Coastal Field Data Collection (CFDC) and Monitoring Completed Coastal Projects (MCCP) Programs, and the FRF. The FRF presentation included an introduction to the proposed collaborative nearshore research experiments of "Duck 94" and "SANDYDUCK." The 59th meeting (Nov. 1993) was held in Point Clear, AL, with the theme "Coastal Wetlands." The approach of organizing each meeting around a theme that was relevant to concerns of the host Division and District and the locality not only allowed the meeting to include an in-depth review of an issue from various vantages but also attracted guest participants from state and local governments and numerous other interested parties. This Coastal Wetlands meeting included presentations representing three of the WES laboratories (Hydraulics, Environmental, and CERC) emphasizing the interdisciplinary challenges in developing research products to address the challenges of coastal wetlands.

The 60th meeting (Nov. 1994) returned to Vicksburg, MS, with the theme "Coastal Research and Development." Presentations focused on the overall Corps and CERC R&D program and then toured or had briefings on the physical and numerical models as well as the field instrumentation and data collection systems. The 61st meeting (May 1995) was in Galveston, TX, with the theme "The Corps' Role in Coastal Zone Management." Board members BG Milton Hunter and Dr. Robert Dean presented a report on the CERB Task Force that had been working on developing recommendation for addressing the Chief's Charge from LTG Williams at the 57th meeting. The meeting also included presentations from various perspectives (historical, international, Federal, several states, and property owners) on Coastal Zone Management. This meeting is notable as one of the rare examples where there were no presentations on coastal research programs, projects, or needs. The 62nd meeting (Oct. 1995) in Fort Lauderdale, FL, did not have a theme and was attended by only the civilian members of the Board plus the SAD Commander who was also a military member of the Board. The meeting agenda was very focused on SAD and specifically Florida coastal issues, which were presented by District personnel. The primary purpose of the meeting was to receive briefings and witness the Corps new LIDAR bathymetric mapping system, SHOALS (Scanning Hydrographic Operational Airborne Lidar Survey), developed through CERC.

The 63rd meeting (June 1996) in San Diego, CA, had the strategic theme "The Direction of Coastal Engineering in the Corps and the Resulting Impact on R&D." The meeting explored the results of recent studies by the National Academy of Engineering Marine Board and the Corps on beach nourishment and shore protection as well as drivers external to the Corps such as ports, the dredging industry, academia, private industry, and State of California initiatives. The meeting included a tour of the University of California's Scripps Institution of Oceanography. As has been the pattern with the themed meetings, there were a substantial number of non-USACE guests (34), many of whom (11) had been asked to give presentations to the Board. The 64th meeting (Jan. 1997) was also in California (Morro Bay and San Diego). It was a small meeting of only the civilian Board members and staff. The 65th meeting (June 1997) returned to the Great Lakes

(Chicago, IL) with the theme "Coastal Engineering in the Great Lakes." The first day of the meeting was dominated by a panel presentation, led by Corps Headquarters, on the "Corps Plus" Strategy, a tie-in to the CERB's strategic plan for a Virtual Coastal Engineering Team and other strategic or programmatic items. Dr. James Houston discussed the upcoming merger of the CERC with the Hydraulics Laboratory. The second day was dedicated to the meeting theme regarding Great Lakes research needs, project applications, and programmatic activities. The 66th meeting (Oct. 1997) in New York was a small Board meeting with no theme and limited participation other than that of the Board and NAD and New York District personnel.

The themed approach had enabled the Board to focus on specific technical and research needs from various vantages and also facilitated the Board's engagement in corporate considerations related to policy, program, and the role of coastal engineering in addressing the Corps overall mission. During this period, the Board had evolved to have less influence and interest on the details of coastal research but instead developed a higher-level focus on strategic goals of the research and the translation into Corps operational practices. Also, during this period, the identifiable coastal research program of the Corps had disappeared. In response to a diminishing research budget and increasing focus on the civil works customer, the Corps research activities had been reorganized around the Corps three major "Business Areas" (Navigation, Flood and Coastal Storm Damage, and Environmental). Toward the end of this period, the CERC merged with WES's Hydraulic Laboratory forming the Coastal and Hydraulics Laboratory (CHL).

The Big Picture Years (1998–2013)

The 67th meeting (May 1998) in Fort Lauderdale, FL, returned to the format of a large, landmark Board meeting, introducing the theme "Regional Sediment Management (RSM)." This is a theme and an initiative that would dominate the Board's attention and influence Corps operational practices for many years continuing beyond the period covered by this report. Several regional scale coastal studies involving sediment management were reviewed as well as R&D needed to support RSM. The attendees included 66 non-Corps guests making this one of the largest Board meetings, giving it the air of a professional symposium. The 68th meeting (Oct. 1998) had separate sessions for the civilian (Wilmington, NC) and military (Norfolk, VA) members, each focusing on tours and discussions related to sediment management. Primarily, this was an opportunity for the civilian members to meet and develop recommendations regarding the RSM concept. Because of the complicated travel logistics and the lack of formal presentations, attendance was limited to the Board, staff, and local District participants.

The 69th meeting (Apr. 1999) returned to Honolulu, HI, with the theme "Military Applications of Coastal Engineering." Old Business included a presentation on RSM by the SAD Commander, BG Richard J. Capka (see interview in Appendix A), but most of the meeting was dedicated to the theme of considering the coastal engineering research needs of the military customer, particularly the U.S. Navy. The 70th meeting (Oct. 1999) was held in Mobile and Dauphin Island, AL, with the theme "Regional Sediment Management." BG Capka had volunteered to serve as the military Board member champion for RSM, and the Mobile District had received funding to conduct an RSM Demonstration Project. At this meeting, the CERB discussed and developed guidance on how to implement RSM. The 71st meeting (June 2000) in Dana Point, CA, also had the theme of RSM but returned to the format of a full meeting with presentations and a significant number of non-Corps guests. The agenda explored RSM from various government level perspectives, with a focus on

California. Updates were provided on several coastal-oriented national programs including the RSM demonstration in Mobile District. The Board had only one official civilian Board member (Dr. Richard Sternberg), but two nominated Board members, Doctors Billy Edge and Bruce Taylor (see interviews in Appendix A), attended as guests. It would not be until the spring meeting of 2002 that the Board would again have its full complement of three sitting civilian members.

Starting in 2000 as Acting Director of CHL and then as Director, Mr. Thomas Richardson would help to guide the CERB until his retirement in 2009 (see interview in Appendix A). He directed that the selection of civilian Board members should follow a process that included collecting nominations from throughout the Corps coastal community and an evaluation board to recommend a candidate for selection to the President of the Board. He also envisioned a civilian complement of Board members that included a range of geographical and professional perspectives. Mr. Richardson's vision helped to orient the Board toward those big-picture issues that would dominate the Board's attention for the next decade.

The 72nd meeting (July/Aug. 2001) was in Galveston, TX, with the theme "Muddy Coasts." There were no sitting civilian Board members in attendance, although the guests included former and nominated future board members: Doctors Sternberg, Edge, Taylor, and Joan Oltman-Shay. The 73rd meeting (Mar. 2002) in Avalon, NJ, had the theme "Beach Nourishment Performance." This meeting heralded the return of a full Board with three sitting civilian members, Doctors Edge, Taylor, and Oltman-Shay, who would remain as a stable asset to the Board for 4 years. This was a full meeting with several panels regarding beach nourishment (Corps, local, private sector) and presentations from FEMA and political leaders. Starting with this meeting and continuing for future meetings, there was significant participation by Corps District offices. MG Robert Griffin, President of the Board, saw the CERB meeting as an opportunity for training and knowledge exchange with coastal professionals from the Corps field offices. The 74th meeting (Sep. 2002) was sponsored by ERDC at the Field Research Facility in Duck, NC. The theme was "Field Data Collection" with presentations ranging from mapping systems through instrumentation networks. This meeting emphasized the Corps role with other agencies in maintaining strong, collaborative, and accessible data management networks.

The 75th meeting (June 2003) in Lafayette, LA, had the theme "Louisiana Coastal Area Ecosystem Restoration" (Figure 10). MG Don Riley was Commander of the Mississippi Valley Division (MVD) and the meeting host. MG Riley would later serve as President of the Board (July 2004–Nov. 2008) (see interview in Appendix A). The Board heard presentations on a broad array of scientific investigations and provided critical feedback to both MVD and the New Orleans Districts. The 76th meeting (Oct. 2003) was in Portland, OR, with the theme "Navigation and Regional Sediment Management in the Northwest." More than 75 people participated including many District personnel who were now engaged in trying to incorporate RSM into pilot projects in their home Districts. A significant take away for the Board was the challenges ahead in attempting to maintain the Corps' coastal infrastructure. The 77th meeting (June 2004) in Traverse City, MI, had the theme "Great Lakes System Management." Presentations include those from the Corps, States, other Federal agencies, and non-governmental organizations. This was the meeting model followed through the Big Picture years of looking at an issue not only from the vantage of different interests but also from different perspectives including cross-discipline, non-technical, and partnering organizations. The Board saw coastal engineering as only one player in dealing with "regions," "systems," and the Corps missions.

Figure 10. 75th CERB, Lafayette, LA. L-R: Dr. R. Bruce Taylor, Taylor Engineering, Inc.; BG Peter T. Madsen, Cmdr. SAD; Dr. Billy L. Edge, Texas A&M University; MG Robert H. Griffin, President, HQUSACE; Dr. Joan Oltman-Shay, Northwest Research Associates; and BG Merdith W. B. (Bo) Temple, Cmdr. NAD.

The 78th meeting (Nov. 2004) in Silver Spring, MD, and the 79th meeting (June 2005) in Anchorage, AK, did not have stated themes. However, they were very different styles of meetings. The 78th meeting included much participation by Corps Headquarters and representatives from several Federal agencies and Boards, as well as Non-Government Organizations (NGOs). There was emphasis on the U.S. Commission on Ocean Policy Report and on both the status and appropriate steps for improving interagency science collaboration. The 79th meeting was very focused on the coastal issues in Alaska, including climate change and the impact on Native American subsistence communities. The 80th meeting (Nov. 2005) in St. Petersburg, FL, also did not have a stated theme; however, the agenda was driven by the Florida 2004 hurricane season and the occurrence only a few months earlier of Hurricane Katrina in New Orleans.

The 81st meeting (July 2006) in Vicksburg, MS, was a joint meeting with the Chief of Engineer's Environmental Advisory Board (EAB). The agenda was structured to explore programs and activities of mutual interest to both Boards with time blocked out for separate discussion sessions for each Board. Briefs included presentations on the post-Katrina activities in New Orleans, Mississippi, and Louisiana. The 82nd meeting (Oct. 2006) was held in Long Branch, NJ, with the theme "Challenges in Coastal Protection and Restoration." The agenda included presentations ranging from the implications of sea level rise to the impact of Corps projects on surfing resources. Presenters included Congressman Frank Pallone, Jr. (6th District of New Jersey), the White House Office of Science and Technology Policy, the National Park Service, U.S. Fish and Wildlife Service, and The Nature Conservancy. This meeting drew a diverse audience that witnessed a

meeting that explored coastal protection and restorations from many technical and non-technical vantages. This meeting was also held in conjunction with ASBPA's National Conference which recognized ASBPA's 80th anniversary.

In June 2007, the Board traveled to the Netherlands on a fact-finding mission designed to foster exchanges with European nations on dealing with coastal risk (Figure 11). This was an executive meeting of the Board with a limited number of participants. The meeting was sponsored by the North Atlantic Division, whose area of responsibility included Europe and has a District office in Germany. Presentations and exchanges were held with representatives from governments, academia, and research laboratories from the United Kingdom, the Netherlands, Germany, and Italy. The mission included an opportunity to see and have briefings on several elements and challenges of the Dutch coastal protection network. The following meeting, the 83rd (Sep. 2007), was held in Alexandria, VA, with the theme "Follow up to Fact-Finding Mission to Europe and Implications for USACE." This was only a one-and-a-half-day meeting with a substantial amount of the time involved in discussing findings and crafting future actions based on the meeting in the Netherlands. Some of the key findings from the Netherlands were recognitions that the European countries are very committed to dealing with Flood Risk: holistically, nationally, and from a system perspective. The Board also entertained flood risk oriented panels that looked at Watershed Management R&D and on Federal and state perspectives.

Figure 11. Fact-finding trip to the Netherlands, 18–22 June 2007. L-R: COL Richard B. Jenkins, Executive Secretary; BG Gregg F. Martin, Cmdr. NWD; Dr. R. Bruce Taylor, Taylor Engineering; Dr. Richard J. Seymour, Scripps Institution of Oceanography; Dr. Joan Oltman-Shay, NW Research Associates; MG Don T. Riley, President, HQUSACE; BG Joseph Schroedel, Cmdr. SAD; and BG Todd T. Semonite, Cmdr. NAD.

The 84th meeting (Apr. 2008) in Mobile, AL, and New Orleans, LA, considered "Regional System-wide Analysis Lessons from Louisiana Coastal Protection and Restoration (LACPR) and Mississippi Coastal Improvement Program (MsCIP)." This meeting and its agenda reflected lessons regarding the importance of taking a systems approach that were learned from the Netherlands visit. The Board focused on the post-Katrina regional system flood risk treatment being advanced by the Corps in Louisiana (LACPR) and in Mississippi (MsCIP). The Board looked at both technical and policy perspectives and emphasized the need to develop models and solutions that cross disciplines and state or Corps District boundaries. The 85th meeting (Sep. 2008) in Portland, OR, addressed the theme "System-based Perspectives of the Coast: A Focus on Pacific Northwest." This was one of the largest CERB meetings ever held with close to 140 participants including numerous District personnel and guests. The agenda focused on system-based activities in the Pacific Northwest including R&D product lines, data collection and information management, and managing risk and sediments.

The 86th meeting (June 2009) in San Diego, CA, focused on the theme "Coastal Data: Requirements and Use." The Board received presentations on the importance of well-managed and assessable data (for climate change, emergency response, navigation, etc.) and on the development of data management systems. The 87th meeting (June 2010) in Jersey City, NJ, considered the theme "Climate Change and USACE Mission Requirements." The location and the theme combined to make this a significant meeting with many guests from both Federal and local governments, academia, NGOs, and industry. Numerous Federal agencies and state governments sent representatives. The agenda moved from presentations focused on the global and national scientific perspective to Corps research and programs, to management and adaptations activities being conducted at the watershed and state level. The meeting concluded with a panel of coastal leads from each Corps Division on the research needs relative to climate change from the perspective of their regions.

The 88th meeting (July 2011) in Niagara Falls, NY, had the theme "Adapting Coastal Systems for the Challenges of the Future." These challenges included managing a large and aging coastal infrastructure portfolio and steps to advance RSM. The 89th meeting (Sep. 2012) in Jacksonville, FL, addressed the theme "RSM – Uniting Navigation, Beaches, and the Ecosystem" (Figure 12).

Figure 12. 89th CERB, Jacksonville, FL, 18–20 September 2012. L-R: COL Kevin Wilson, Executive Secretary; BG Kent D. Savre, Cmdr. NAD; Mr. William H. Hanson, Great Lakes Dredge & Dock Co.; BG Michael J. Wehr, Cmdr. SPD; MG Michael J. Walsh, President, HQUSACE; Mr. John R. Headland, Moffett & Nichol; BG Donald E. (Ed) Jackson, Jr., Cmdr. SAD; and Dr. David L. Kriebel, U.S. Naval Academy.

This meeting explored how an RSM approach could help to bridge multi-purpose and multi-agency missions and then how R&D could help to meet the challenges. The final meeting of the first 50 years of the CERC was the 90th meeting (Sep. 2013) in Long Branch, NJ, with the timely theme "Hurricane Sandy Response, Recovery and Resilience" (Figure 13).

Figure 13. 90th CERB on the New Jersey shore inspecting damages from Hurricane Sandy and discussing options for improving coastal resilience. MG Walsh, President of the CERB, is in the center of this photo.

During the Big Picture years, the CERB evolved further, paralleling the Nation's and the Corps evolution. There was less emphasis on the details of developing the technology and much more emphasis on exploring the coastal system challenges and then identifying the technological needs to address these issues. As the Board matured through the Big Picture years, the meetings became significant coastal gatherings attracting individuals from various levels and regions of the Corps, and participants from other Federal agencies, working group and programs, state governments, local officials, universities, NGOs, and industry. Several meetings welcomed international visitors. The agenda had less to do with the details of the Corps coastal R&D program and more to do with the overall state of the technology, including the work of others engaged in coastal-related research. The Board focused on the big problems of climate variability, regions, systems, multipurpose use, interdisciplinary coordination, environment, economics, and policy.

In summary, between 1963 and 2013, the CERB evolved paralleling the changing dynamics and interests of the profession of coastal engineering, the Corps, and the Nation. For ease of discussion, that evolution has been organized into four periods.

1. **The Early Years (1964–1980):** Focused on the details of the Corps coastal research activities, development of guidance, development of coastal engineering as a recognized profession, U.S. leadership in coastal, project review engagement.

2. **The Transition Years (1980–1987):** CERC move, growth of the FRF as a center for coastal data and field experimentation, development of numerical models, diminishment of independent coastal R&D program, Field Review Groups (FRGs) made up of District coastal experts guide R&D investments.

3. **The Theme Years (1987–1998):** Focused meetings on technical areas of interest (Sea Level Rise, Climate Change, structures, sediment management, etc.). Explored issues from different vantages. Opening of meetings to non-USACE and partner organizations. Traditional R&D investment decisions moving from coastal technical experts to business areas. An identifiable coastal research program no longer exists. Development of new research programs (CIRP, DOER) funded by Operations and Maintenance.

4. **The Big Picture Years (1998–2014):** Incorporating technical knowledge into Corps practices. Looking beyond coastal and R&D toward role of technology to address more holistic problems such as climate, regions, systems, and risk management. Incorporation of more external voices into dialogue including academics, other agencies, and state representatives.

Contributions of the CERB

Each of the Oral History interviewees (Appendix A) were asked this as a final question: "What did the CERB do?" The purpose of this question was to evoke their thoughts on the value of the CERB from the perspective of their careers, the field of coastal engineering, the Corps, and/or the Nation. The responses covered a broad array of positive impacts, many delivered with a passion recognizing real value to them personally. There are also specific programs, research areas, or technological advancements that were specifically accredited to the CERB. These include the development of the Corps portfolio of coastal engineering guidance documents and internal training programs, research into sediment transport, dredging, and inlets, the development of an international status for Corps research, advancements in concrete armor design, increased professionalism in data acquisition and management including advancements in coastal mapping, promotion of Regional Sediment Management and Systems approaches, and the avocation of the Corps as an ocean organization. Additional specifics regarding these advancements follow in this section.

Less-specific impacts included the professional relationships, experiences, and friendships that developed between Board members and the Corps research community. These mentorships and collaborative exchanges would very often continue for many years after the Board member had cycled off of the Board. In addition, the CERB staff saw that the CERB could serve as a vehicle for drawing the attention of Corps senior leadership to technology issues. This helped to facilitate an appreciation at the highest levels of the Corps of the potential for research to enable the Corps to better perform in all its mission areas. Division Commanders, the Director of Civil Works (Deputy Commanding General for Civil and Emergency Operations), and even the Chief of Engineers witnessed the products of R&D and received recommendations from the Board that promoted the incorporation of technology into practice. In some cases, the recommendations of the CERB could also expedite the process to fund research or projects that would advance the coastal sciences. Examples are investments in an RSM demonstration program and dredging and inlet research programs. The military Board members valued the dialogue with the civilian professionals as it helped them to better understand the technology and challenges that could affect project decisions under their command. The Board President and other military members saw the meetings as an opportunity to hear directly from District professionals without the filtering of intermediaries. In his interview, MG Riley emphasized how impressed he was with "the broad talent and expertise of the Corps." For the civilian members, service on the Board was a professional honor that not only helped their careers but also gave them a better understanding of the Corps and the practical problems of dealing with real world projects. Many Board members remarked that their experience on the CERB lead them to develop lifelong professional relations and friendships.

Specific Advancements Credited to the CERB

a. **Guidance and Training (TR-4, SPM, CEM, CERCU).** The Beach Erosion Board Technical Report No. 4 was replaced in 1973 with the first publication of the Shore Protection Manual (SPM) (Figure 14). This report and the revisions in 1975, 1977, and 1984 have served as the worldwide "bible" of coastal engineering. The SPM has been translated into many languages and is still used for training as well as practice throughout the world. It was primarily written by staff of the CERC but with significant guidance and input from the CERB civilian members. It was the guidance document for coastal engineering until the Coastal Engineering Manual (CEM) was released, starting in 1992 in six parts. Several CERB members or former members were engaged as authors and reviewers of the CEM. The CEM was a significant advancement over the SPM as it incorporated many of the post-1980s concepts associated with spectral wave

theory, numerical simulations, and sediment transport and has a broader application scope than only shore protection. In response to LTG Heiberg's "Chief's Charge" of 1985, a collaborative master's level coastal engineering program was established between Texas A&M University and the Corps of Engineers. USACE District and research engineers interested in advancing their coastal engineering training could apply through a Corps-sponsored long-term training program to participate in a 1-year program that included two semesters of class room training at Texas A&M and a summer semester at the CERC leading to a master's degree. This program was nicknamed "CERC U" and led to a trained cadre who include many of the senior coastal engineers of today's Corps. Additional short-term (1 to 2 week) courses were developed and offered to District personnel in coastal planning, engineering, and geology (Figure 15).

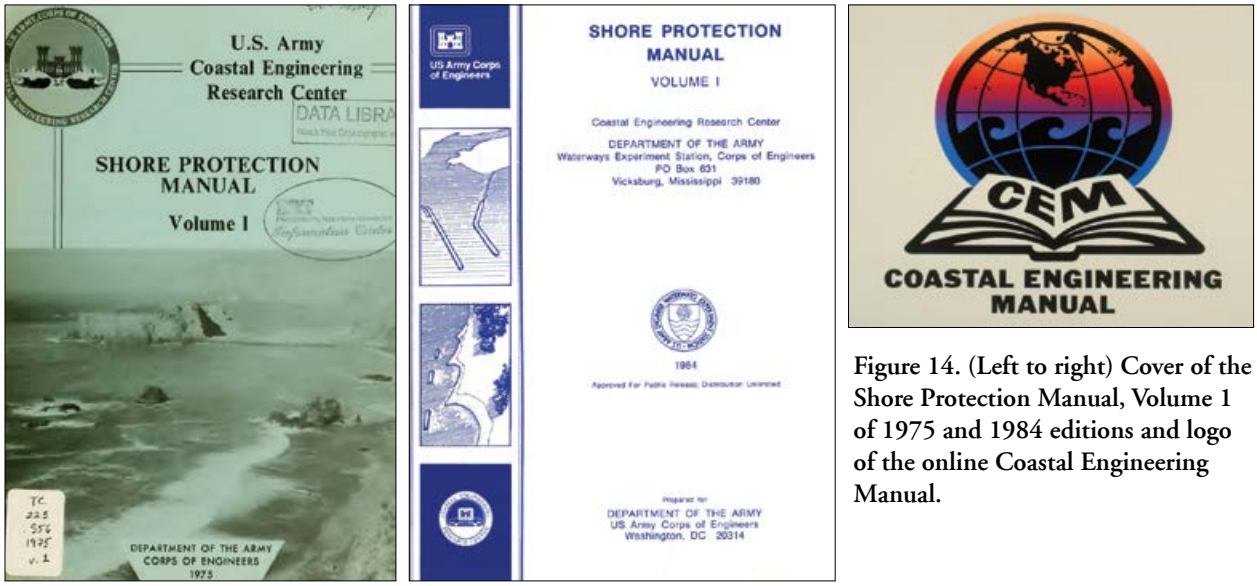


Figure 14. (Left to right) Cover of the Shore Protection Manual, Volume 1 of 1975 and 1984 editions and logo of the online Coastal Engineering Manual.

Figure 15. USACE Coastal Planning course held at the Field Research Center. Class participants at the top of Jockey's Ridge, Nags Head, NC. Actual date unknown, but from mid-1990s.

b. **Project Specific Technical recommendations (use of breakwaters, data management, concrete armor units, improved monitoring, etc.).** Once the CERB meetings were no longer limited to being held at the Laboratories, the Board started to consider the conduct of and issues associated with various Corps projects. It was not unusual for the host Division and Districts to highlight particularly challenging or high-visibility projects at the Board meetings. The Board, particularly the civilian members, would freely offer advice and suggestions regarding the design, data collection, and/or R&D products that could be of benefit to the project. Their recommendations were usually taken to heart by the District Commanders and would lead to the incorporation of cutting-edge technology into Corps coastal projects. One example is the use of breakwaters at Presque Isle, PA. Based on recommendations of the CERB a prototype suite of three breakwaters was constructed and monitored. This monitoring data were then used to drive a physical model study that lead to the eventual construction of 55 breakwaters (Gorecki and Pope, 1993) (Figures 16 and 17). Another example was a concern regarding the integrity of pre-cast concrete armor units (such as dolos) used in coastal navigation structures. Cracking and breakage of these units could compromise the stability of the armor cover, exposing the breakwater to potentially significant damage. This concern, heightened by the 1978 major breakwater failure in Sines Portugal (Baird et al., 1980), led the CERB to recommend a program of instrumented and monitored armor units on the Crescent City, CA, breakwater in the 1980s. This combined field, physical model, and numerical analysis study provided the unit stress-strain data base that eventually led to the development of a Corps of Engineers unique concrete armor unit called "Core-loc®" that is less fragile and more stable than previously used artificial breakwater units (Melby and Turk, 1997) (Figure 18). Real world projects and their lessons often lead the Board to make recommendations that are directly traceable to advancements made by the Corps research community.

Figure 16. Physical model study conducted at the WES 1980–1982. Model was used to test various configurations of a detached breakwater system for stabilizing the shore at Presque Isle, PA.

Figure 17. Detached breakwater system constructed at Presque Isle, Erie, PA between October 1989 and November 1992.

Figure 18. Core-locs and Core-loc placement on the jetty at Kaumalapau Harbor, Lanai, HI in 2007.

c. **Development of Numerical Models.** The earliest tools for coastal engineering were based on field observations and measurements. During the 1950s through 1970s, the BEB and later CERC and WES developed and significantly advanced the craft of using scaled physical models and experimental laboratory facilities to study both site-specific conditions and also to develop the data sets necessary as the foundation behind empirical relationships. Most of the design guidance contained in the SPM came from laboratory studies of hydrodynamic processes, sediment geomorphic response, and wave-structure interaction. In the mid-1970s, increased computational power allowed for the development of numerical simulations of processes, such as being able to hindcast wave conditions from measured meteorological conditions. WES took the lead in developing numerical simulations of wave conditions and transformation. The CERC at Fort Belvoir was slower in embracing this new analytical approach. The CERB had a significant role in directing the CERC at Fort Belvoir to consider numerical simulations including some initial work in modeling beach response. But, it was not until the transfer of CERC to Vicksburg and WES that numerical simulation was fully embraced as the third tool (beyond field data and physical modeling) for coastal engineering analysis. Since the early 1980s, the CERB has performed a critical function in identifying the need and endorsing the development of new numerical tools. The agendas for almost every meeting would include a review or discussion of a numerical model application or technology development and CERC continues to aggressively advance the Corps capabilities (Figure 19).

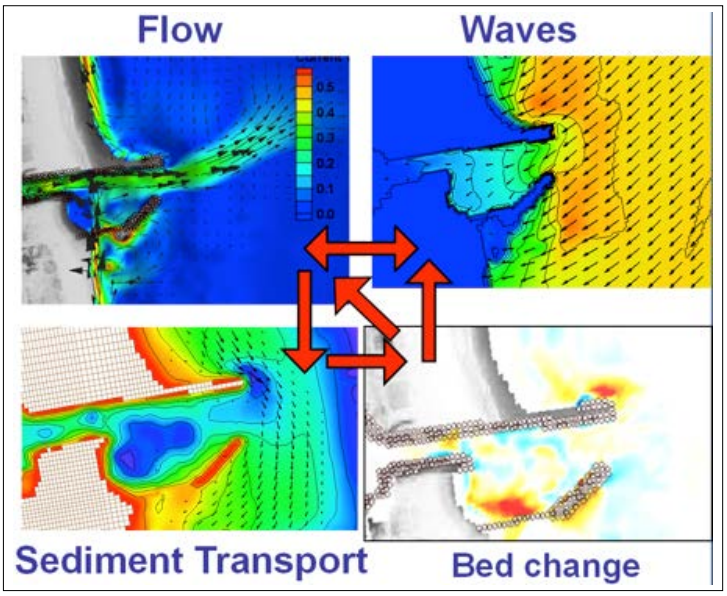


Figure 19. Schematic of the Corps Coastal Modeling System illustrating the interaction of processes (waves and flow) with response (sediment transport and morphology change.

d. **Data (collection, management, sharing, LIDAR mapping, monitoring).** The earliest civilian members of the CERB, Dean O'Brien, Dr. Saville, and Professor Ippen, were advocates of the importance of field data in driving the development and testing of scientific relationships and engineering technologies. The recommendations, promotion, and design ideas of the CERB were instrumental in obtaining funding for the Field Research Facility (FRF) at Duck, NC (see Figure 2). The CERB influenced many aspects of the FRF's facilities and operational protocols. The contribution of the FRF in amassing a nearly 40-year history of synoptic meteorological, hydrodynamic, sediment, and landscape evolution data is recognized throughout the professional coastal and oceanographic research community (Birkemeier and Holland, 2001) (Figures 20 and 21). The CERB has frequently advocated investments in field data systems including the development of a wave gauging program, promoting advancements in wave and current instrumentation, and field experimentation on structures and sediment behavior. A major program that benefited from the endorsement of the CERB is the development of an airborne LIDAR bathymetric

mapping system (Figure 22). This lead to the development of the SHOALS program and the current existence of the Army-Navy-NOAA-USGS JABLTCX (Joint Airborne Bathymetric Lidar Technical Center of Expertise) which is responsible for mapping underwater areas along the Nation's coastlines and many other areas of the world (Wozencraft and Lillycrop, 2006). In recent years, the CERB had promoted the partnering of the Corps with other agencies in developing collaborative data sets and data sharing via such vehicles as the IOOS (Interagency Ocean Observation System). These various coastal and oceanographic data sets provide the real-world truth with which all scientific advancements and engineering technologies much comply.

Figure 20. ERDC's Coastal and Hydraulics Laboratory senior staff meeting at the Field Research Facility (May 2000).

Figure 21. Hurricane Sandy (October 29, 2012) storm waves at the FRF instrumented pier.

Figure 22. Airborne LIDAR bathymetric mapping system, operated by the JALBTCX, uses topographic and bathymetric lidar and hyperspectral imagery to measure the coastal zone around the U.S.

e. **Dredging Research.** In 1984, William Murden of the Dredging Division of the Corps WRSC addressed the CERB and requested the CERB's assistance in developing technology that could be used to better predict the behavior of dredged material placed in the nearshore and offshore. The presentation led to discussions about the technology needed to monitor and eventually predict the behavior of nearshore berms and deeper water mounds (sometimes referred to as "Murden's Mounds"). The CERB developed recommendations on research needed to address a number of issues related to the sediment behavior associated with dredging and dredged material placement. The Mobile District and the CERC worked together to construct and monitor a nearshore berm and an offshore dredged material mound off of Dauphin Island, AL. This demonstration and the CERB's continuing interest led to the development of the Dredging Research Program (DRP) which continued through the mid-1990s. With an investment of funds from the Corps' Operation and Maintenance Budget, the DRP tackled numerous physical and scientific issues associated with advancing and monitoring dredging equipment, improving field instrumentation, and developing hydrodynamic and predictive sediment transport models. One example of a significant outcome from the DRP was the initial development of the ADCIRC (Advanced Circulation) storm surge modeling system that has since become the major engineering tool for predicting storm surges, currents, and coastal flood levels. The DRP was replaced in the late 1990s by the Dredging Operations and Environmental Research (DOER) Program. DOER is a continuing R&D program to address all the physical and environmental aspects of the Corps dredging mission. Throughout the development of both of these research programs, the CERB continued to receive briefings and provide recommendations on investment directions and the technology.

f. **Research on Inlets.** Starting in 1969 and through the 1970s, CERC and WES were each engaged in research on inlets and inlet processes via the Generalized Investigation of Tidal Inlets (GITI) Research Program (Sorensen, 1980). The GITI was a limited-duration, applied-research program that included field studies, analysis of historical data, development of numerical models, and physical model studies to improve USACE capabilities in managing inlets for navigation, beach erosion, and coastal flooding purposes. The program was closely tracked by the CERB with presentations on products or program activities at most meetings. The GITI produced a phenomenal body of internationally recognized work on inlet hydraulics and sediment transport (Figure 23). However, this program ended in the early 1980s, and any further research specific to inlets was absorbed into the overall coastal research program. At a meeting in the late 1980s, MG Hatch, as President of the Board, famously commented that the Corps' three biggest Civil Works coastal problems were "Inlets, Inlets, Inlets." Coastal Inlets became the theme for the 53rd CERB (June 1990) and that kicked off a renewed recognition of the need to advance many areas of research related to inlets. With continuing funding through the Corps Operations and Maintenance budget, the Coastal Inlets Research Program (CIRP) was initiated in the mid-1990s with the first publications and products produced in 1997 (Rosati et al., 2013) (Figure 24). CIRP activities frequently are on the agenda of CERB meetings. The CERB has had a major role in emphasizing the criticality of understanding inlet processes to better manage dredging costs and the impact of sediments within regions.

Figure 23. Two example publications produced by the GITI program in the 1970s. These two publications were both landmarks in tidal inlet research that are still frequently referenced.

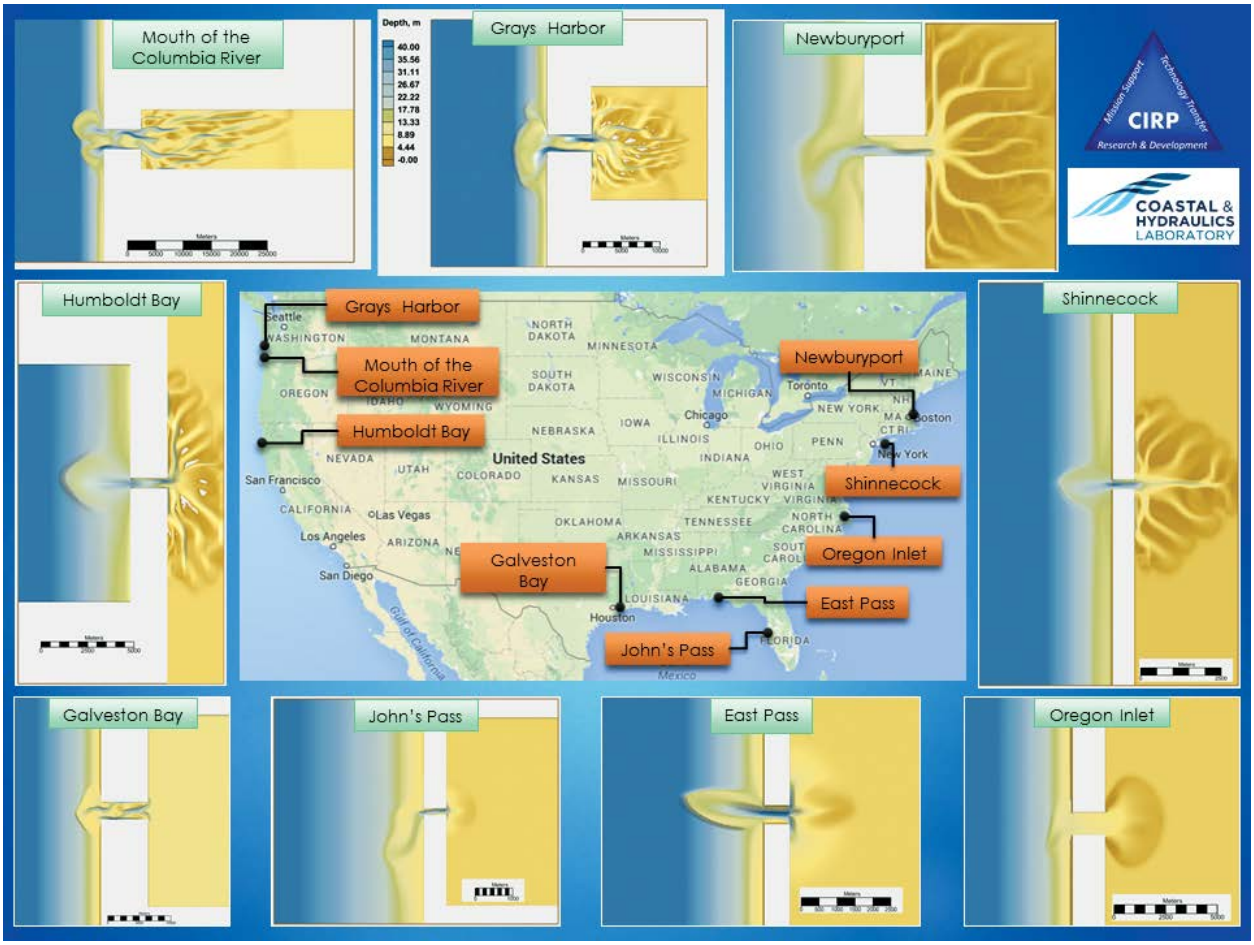


Figure 24. Example of CIRP product illustrating long-term numerical model applications for idealized coastal inlets from the United States' East, West, and Gulf Coasts.

g. **Regional Sediment Management and Systems Approach.** As early as the 9th meeting (Oct. 1967), the Board entertained discussions about developing regional studies that went beyond the traditional project based analysis. As the science of numerical modeling developed, the Board frequently endorsed the need to develop regional or hydrodynamic model systems that could then be used to drive the detailed model for a specific project need. As computer technology improved, further efficiencies could be realized through the development of multi-use and multiple-access data bases. The Corps Lidar mapping system (SHOALS) developed in the early 1990s provided for the first time a three-dimensional picture of both the above- and below-water morphology. The concept of managing water within a river basin as a water-shed system was gaining traction within the inland professional community. These technologies, as well as the growing recognition of the need to look beyond the project footprint in considering environmental impacts, led the CERB to recognize the opportunity to identify and then analyze the coastal area as an integrated system. There were many steps in the process of moving from a project-centric view to a regional or system-centric view, but the first step was to develop the technology that could map and analyze temporal and spatial coastal processes. The 67th meeting (May 1998) addressed the theme "Regional Sediment Management (RSM)." Although the waters of coastal regions cannot be managed (in the same way as river systems), the sediment is a resource that the Corps can manage (primarily through its dredging program). RSM is a means by which the sediment within a system is considered as a resource that can be optimized and preserved through the coordination of the activities of all stakeholders. RSM is a concept that was born at a CERB meeting and has since been nurtured and continues to be promoted by the CERB. Since 1998, numerous CERB meetings became forums for interagency discussions on sediment management challenges and opportunities. An RSM demonstration was initiated in Mobile District in 1999 and since has grown to a continuing national program that includes R&D applications, collaborative District and partner implementations, and policy adaptations (Figure 25). The concept of RSM has been embraced by other Federal and state agencies and has become part of the Corps operational model.

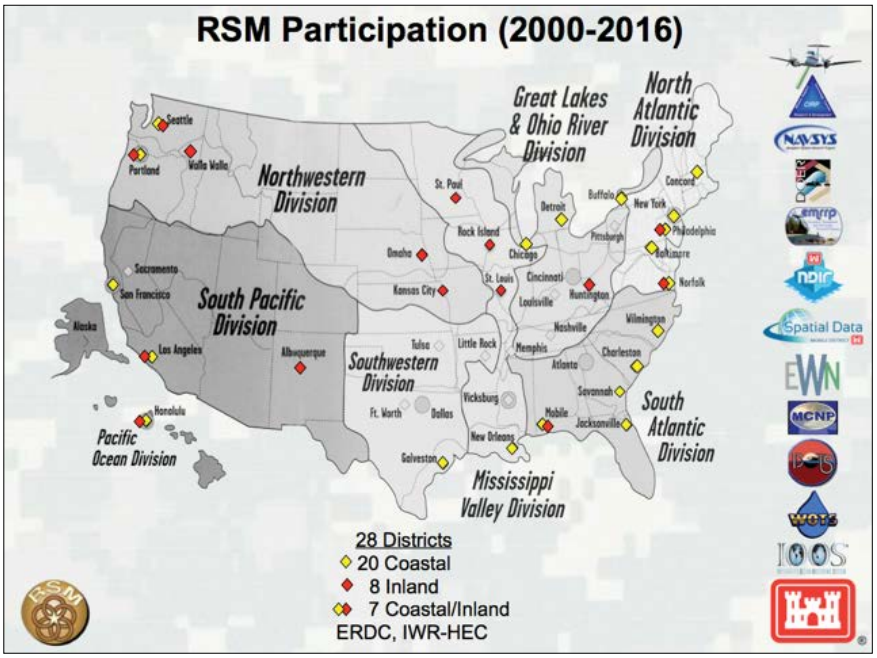
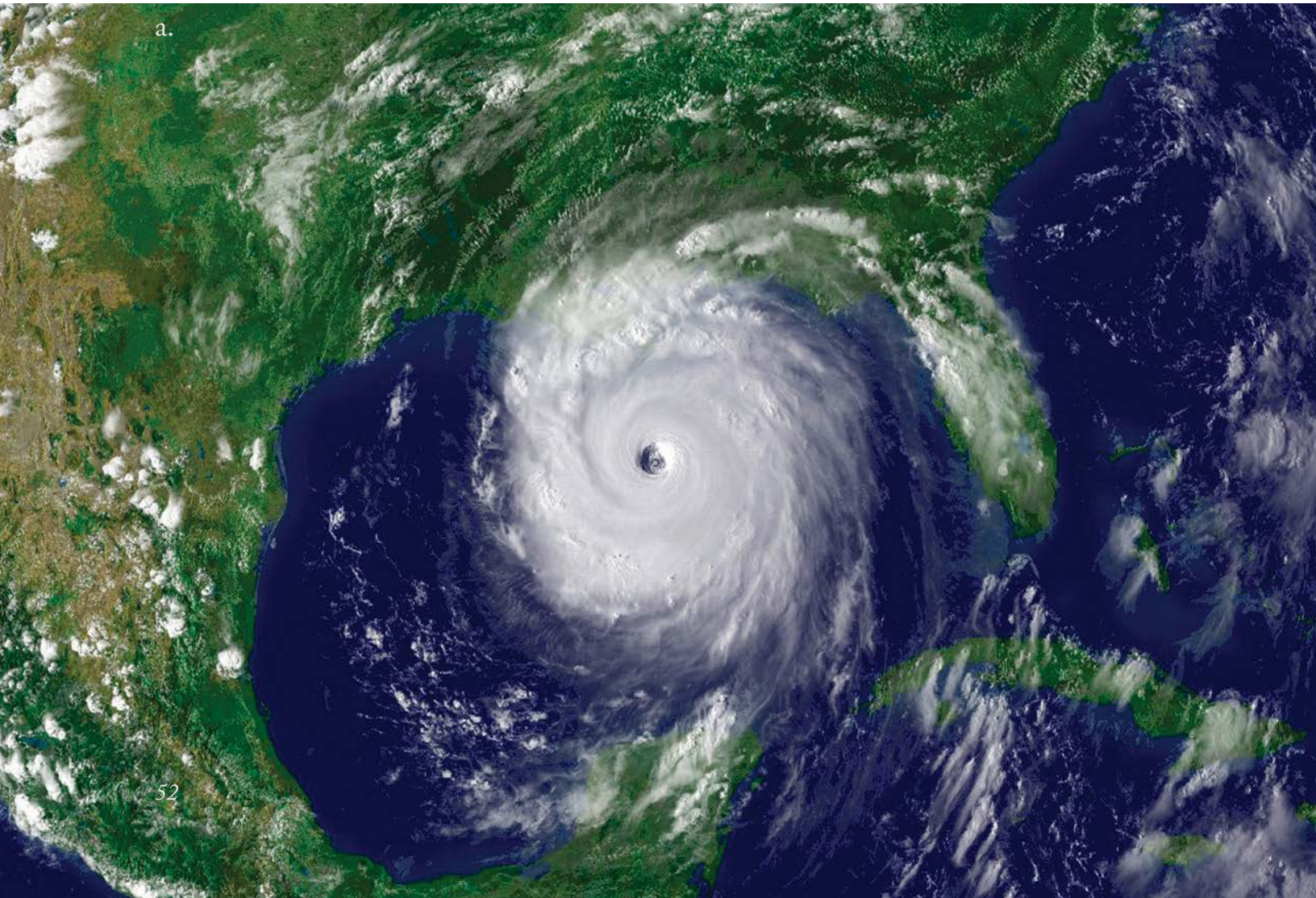


Figure 25. Graphic illustrating the national scope of the Regional Sediment Management program that was incubated and fertilized by the CERB.

Figure 26. Repair of damaged Dolosse section of Cleveland East Breakwater with 6.5 ton units being placed over (much smaller) 2.5 and 4 ton unit cover (2015–2016).

h. **Coastal Structures.** The development of design criteria to develop stable navigation and shore protection structures was a critical part of CERC's mission, and the CERB was engaged many times in promoting both structural stability and functional performance of coastal structures. The earliest meetings included reviews and discussions regarding the various physical model facilities at both CERC and WES. The Board frequently weighed in on technical needs for improvements to existing basins and tanks and new facilities. Their recommendations were an important consideration before funding commitments would be made for testing facilities. By 1969, the CERB was engaged in diverse interests relative to structures including rip-rap stability, sheet-pile corrosion, and the potential construction of prototype-scale field testing facilities. In the late 1970s and early 1980s, the CERB began to focus more on the functional design of structures including the development of new and innovative structures such as constructing sediment trapping weirs in jetties and the use of detached nearshore breakwaters for beach erosion control. By the mid-1980s, the CERB focused on the problem of instability in pre-cast concrete armor units on breakwaters and jetties. The Board endorsed the previously described integrated program that included prototype monitoring and instrumentation of the dolosse cover on the Crescent City Breakwater in California with the data feeding subsequent laboratory modeling and the development of numerical finite element stress-strain mathematical analysis (Howell and Melby, 1991). In the last couple of decades, the Board has championed the need to address research issues associated with the Corps' large portfolio of aging coastal infrastructure including condition evaluation protocols and methods for maintenance and rehabilitation (Figure 26).

i. **Risk and reliability and resilience.** The Board's perspective has played an important role in emphasizing that the level of protection that can be offered to coastal communities through engineering works is not an absolute. Coastal structures and management activities cannot provide complete protection from the power of hurricanes and major extratropical storms. The damages caused by Hurricane Katrina (2005) (Figure 27) illustrated that structures can fail when events exceed design and that it is not practical to design a structure to survive the most extreme event. An important lesson of Katrina has been the realization that all players need to work together through various engineering and management actions to reduce a risk of damages and to improve the reliability of the infrastructure system. Several Board meetings were held after Katrina (including the June 2007 fact-finding mission to the Netherlands) to explore the science and technology needed to better assign a level of risk and reliability. The recognition that science was needed to manage coastal systems in consideration of severe storms and climate change induced sea level rise has been significantly nurtured through dialogue at Board meetings. Superstorm Sandy (2012) caused further maturity in the concept of managing coastal systems. Coastal systems are not only dependent upon structural systems that reduce risk of damage but are also dependent upon the resiliency of the community. Coastal communities with greater development at risk and less ability to rebound have less resilience. Since Hurricane Sandy several Board meetings have focused on the concept of resilience including recommendations for focused research on this topic.



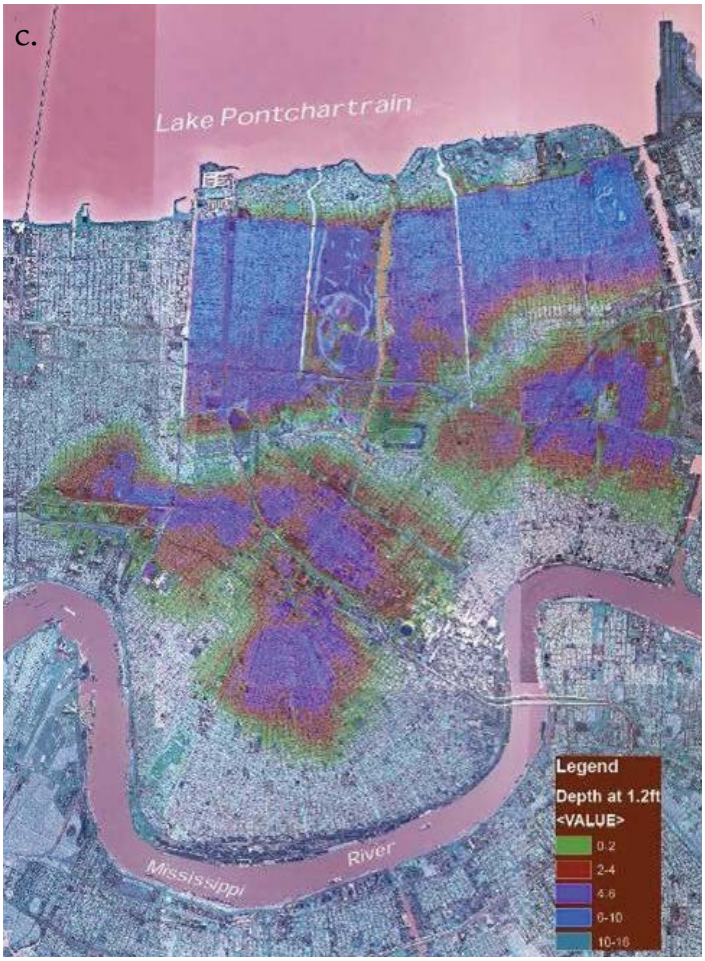


Figure 27. a.) Hurricane Katrina, as a category 5 hurricane (September 2005) bearing down on the Gulf Coast of Louisiana and Mississippi. b.) Storm surge in the New Orleans Inner Harbor Canal and flooding of the 9th Ward. c.) Mapping of flood levels in New Orleans. d.) Physical model study of the 17th St. Canal.

j. **Corps role as world leader in coastal.** Civilian members of the Board were specifically selected because they were internationally recognized leaders in coastal research. They were usually well published with significant professional stature. From 1966 through 2000, CERB member Dean Morrough O'Brien followed by Dr. Billy Edge served as the editor of the Proceedings for the American Society of Civil Engineering (ASCE) biennial International Conference on Coastal Engineering (ICCE). Others such as Professor Robert Weigel, Doctors Robert Dean, Anthony Dalrymple, and Paul Komar were frequently employed as international consultants and on National Academy of Science study teams. Civilian members Doctors Bernard LeMehauté and Bruce Taylor ran successful coastal engineering firms with many international clients. At the end of a presentation, it was not unusual for the Board to congratulate a Corps researcher or District presenter on the quality of their work and recommend publication in a peer-reviewed journal or presentation at the ICCE or at other significant national venues. Civilian Board members usually came from academia and saw educating young CERC, WES, or CHL researchers on the potential of their work and the value of a good professional vetting as a part of their role. They would provide one-on-one advice to Corps researchers, helping them to identify academic or foreign researchers with similar interests and assist in developing collaborations. Board members also helped to promote the value of Corps products (for example, the Shore Protection Manual) to their international colleagues. The civilian Board also recommended to the military Board members that they attend coastal engineering professional forums to see first-hand how well received and important the Corps' research was to the world stage. Several military members attended ICCE and coastal engineering specialty conferences. MG Donald Riley, President of the Board (2004–2008), was the keynote speaker at the 2006 ICCE in San Diego, CA.

k. **Corps role as U.S. ocean agency.** Traditionally, the Corps has seen its civil works role tied to the Nation's river systems with limited mission interest beyond the shoreline. However, particularly in the 2000s, the Board recognized the contributions of the Corps, its missions, data sets, regional models, and research products as providing significant value relative to coastal and ocean systems. The Corps channel dredging and dredged material placement operations are important in coastal RSM and nearshore ecosystem sustainability. Led by Doctors Joan Oltman-Shay and Richard Seymour (who were both involved in the development of the U.S. Ocean Policy and members of various national scientific forums), the Board recommended to the President of the Board in the 2000s that the Corps think of itself as an "ocean agency." That led to increased involvement of the Corps in various ocean science and policy working groups including membership in the IOOS. Representatives of other ocean agencies such as the National Oceanic and Atmospheric Administration (NOAA), Department of the Navy, U.S. Coast Guard, and the U.S. Geological Survey were frequent invitees and presenters at Board meetings. Important outcomes of this perspective include extended collaboration between the Corps and NOAA and membership by the Corps and the Assistant Secretary of the Army for Civil Works on interagency ocean policy groups.

Conclusion

This report provides a historical context for documenting the role of the Coastal Engineering Research Board in developing America's profession in the field of coastal engineering and science. The CERB is an advisory board of the Corps of Engineers that evolved from previous organizations and early pioneering scientific work to facilitate the development of those understandings, technologies, policies, and professionals that could help America to better address the challenges of navigation and population along the coast. Coastal engineering is a relatively modern specialty that was significantly advanced during the twentieth century through the work of the CERB and its predecessor organizations.

The CERB was created in 1963 because of a continuing recognition by the Congress and the Corps that Federal investment in coastal sciences was needed to facilitate rational development activities along the coast. The coastline of America was recognized to be a dynamic resource that needed to be understood and managed as a public responsibility. Unlike many other engineering professions, there was not a competitive commercial market place driving the need for technology advances and the education of a cadre of practitioners. Thus, the Corps had to develop the people and the technology needed to perform its mission responsibilities in the coastal arena. During the 50 years since its original charter, the CERB has continued to evolve as the technology has advanced, as the function and operation of the Corps has changed, and as the public has recognized the hazards and unique environmental demands of its coastal investments. Historically, the CERB has refocused its vision in response to the demands of the profession, the Corps, and the Nation. The CERB is expected to continue to evolve in response to changes in the national dialogue regarding coastal investments, the environment, public safety, economic development, and the challenges of climate variability.

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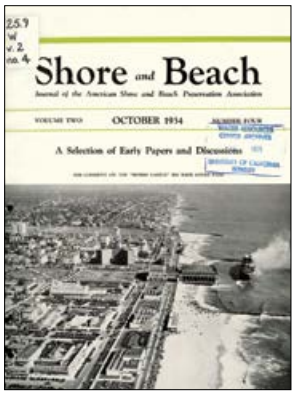
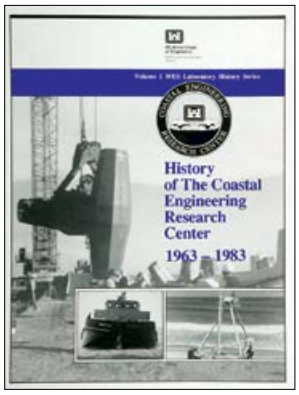
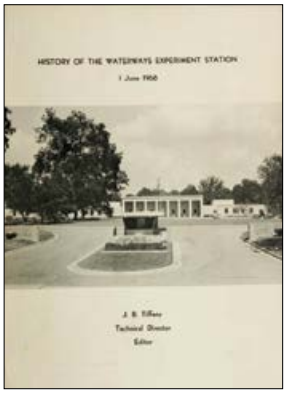
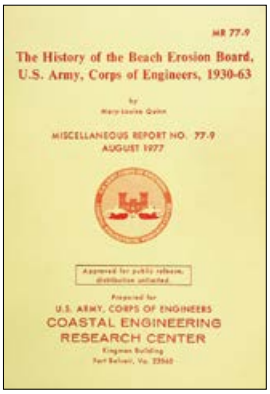
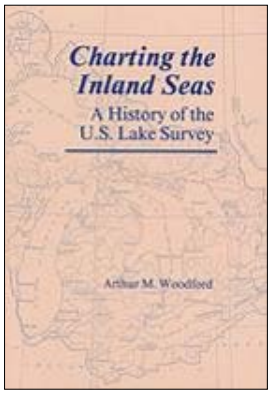










Appendix A

CERB Oral History Interviews

Between 26 April and 8 October 2013, 19 former CERB Executives (7), Civilian Members (7), Military Members and Presidents (5) were interviewed. The goal of each interview was to document their memories, experiences, and thoughts specifically in regard to their engagement with the CERB. The service of these individuals covers the first 50 years of the CERB's existence (1963–2013). The list of interviewees including their roles and periods of service is documented in Table A-1.

Each interviewee was asked a series of questions designed to lead to a dialogue regarding their individual career backgrounds, their knowledge and experience with the CERB, and their thoughts on the significance of the CERB to themselves, the profession of coastal engineering, to the Corps, and to the Nation. All interviews were recorded and the recordings archived with the Corps of Engineers Office of History. Each interview was consolidated by the author into the attached summaries per interviewee. These summaries are paraphrased "notes" and not meant to be verbatim except where shown within quotes. Each interviewee was sent a draft summary of their interview and asked to review, comment, and/or clarify. The final summaries were approved by each interviewee.

The summaries in this Appendix appear in the order shown in Table A-1. The CERB Executives are listed first, followed by the Civilian Members and then the Military Members/Presidents. Each group is organized in the order of their first engagement with the CERB. Thus, the first summary is for Mr. Thorndike Saville, Jr., who was the second director of CERC and involved in CERB meetings from the very beginning in 1963. The final summary included is for MG Michael Walsh, Ret., who was the 24th President of the CERB. MG Walsh approved and requested the development of this historical review.

		Period of Service							
	Role	1960s	1970s	1980s	1990s	2000s	2010s	Location	Date of Interview
Mr. Thorndike Saville, Jr.	Executive	1963–1981	1963–1981					DC	9 May 2013
Mr. John (Jay) Lockhart	HQUSACE			1979–1997	1979–1997			VA	26 Apr. 2013
Dr. Robert Whalin	Executive		1971–1998	1971–1998	1971–1998			MS	5 June 2013
Dr. James Houston	Executive			1986–2010	1986–2010	1986–2010		MS	12 Aug. 2013
Mr. Charles Calhoun	Executive			1985–1999	1985–1999			MS	4 June 2013
Mr. Charles Chestnut	HQUSACE				1993–2014	1993–2014	1993–2014	VA	21 May 2013
Mr. Tom Richardson	Executive					1999–2009		MS	5 June 2013
Dr. Robert G. Dean	Civilian member	5/69–5/81	5/69–5/81	5/69–5/81	9/93–4/00			FL	13 Aug. 2013
Dr. Robert A. Dalrymple	Civilian member			9/89–10/93	9/89–10/93			MD	3 June 2013
Dr. Fred Raichlen	Civilian member			9/89–10/93	9/89–10/93			CA	17 July 2013
Dr. Paul D. Komar	Civilian member				10/92–9/96			OR	9 Aug. 2013
Dr. Billy L. Edge	Civilian member				5/98–5/00	2/02–3/06		NC	12 July 2013
Dr. Joan M. Oltman-Shay	Civilian member					10/01–10/07		WA	3 Oct. 2013
Dr. R. Bruce Taylor	Civilian member					2/02–3/09		MD/FL	3 June 2013
MG Patrick Kelly	Mil-Pres			6/88–6/91	6/88–6/91			NJ	3 Sep. 2013
BG J. Richard Capka (SPD, SAD)	Mil Member				11/96–10/00	7/98–10/00		DC/VA	22 July 2013
MG Merdith (Bo) Temple (NAD)	Mil-Pres					2/03–7/05		VA	20 Aug. 2013
MG Don T. Riley	Mil-Pres					2004–2008		DC/VA	10 July 2013
MG Michael Walsh	Mil-Pres					7/04–8/06	12/11–11/13	DC/VA	8 Oct. 2013

"The idea behind the pier was to see if what we did in the laboratory was real.... What has come out of the pier influences how we do things."

"The value of the CERB has been significant, especially in the early years. Just discussing our research with people who know a lot in the field is like a retreat. The ideas that came out were very useful."

Thorndike Saville, Jr.

(Technical Director, Coastal Engineering Research Center, 1971–1981)

Mr. Saville was interviewed on 9 May 2013 in the District of Columbia. Mr. Saville started his professional career in hydraulic engineering before he was even born, as both his father and grandfather were working in the profession. His father, also named Thorndike Saville, is recognized as one of the founding fathers of coastal engineering in the United States. Dr. Saville (senior) taught at North Carolina, Chapel Hill and New York University and was one of the original members of both the Beach Erosion Board and Coastal Engineering Research Board (1963–1969). Mr. Saville (junior) graduated from high school in 1942 and went to Harvard University for a year before joining the Army in 1943. As a U.S. Army Weather Observer he collected meteorological data first along the Atlantic seaboard then in theater in the Pacific. His duty stations included New Guinea and the Philippines. After the war he went back to Harvard to complete his undergraduate work in civil engineering (Bachelor of Science, 1947). Graduate school was at the University of California at Berkeley where he studied and conducted sediment transport physical modeling tests under Professor Joe Johnson. He was hired by General Edgerton to work for the Beach Erosion Board (BEB) and was immediately assigned to conduct studies of sediment and water movement in the Mission Bay and San Diego area. In 1950 he moved east to work at the BEB at Dalecarlia Reservoir in DC. His entire professional career was in the employment of the Corps of Engineers, first for the BEB and then for the Coastal Engineering Research Center (CERC).

Mr. Saville's primary research was on wave hindcasting and developing wave statistics leading to wave forecasting and wave inshore processes including overtopping and run-up, and beach sediment transport. This also led to studies to determine and predict storm surges. Much of this work was done in the physical model tanks available at Dalecarlia. He also conducted stability of rock large-scale experiments, testing and verifying Hudson's formula in the large CERC wave tank. In 1963, when CERC was established, Mr. Saville was Chief of the Research Division. The transition from the BEB to CERC expanded their research mission from the limits associated with studying beach erosion to researching deeper water processes and the stability of navigation structures. The District beach erosion reports review that had been a function of the BEB was transferred to the Board of Engineering for River and Harbors (BERH).

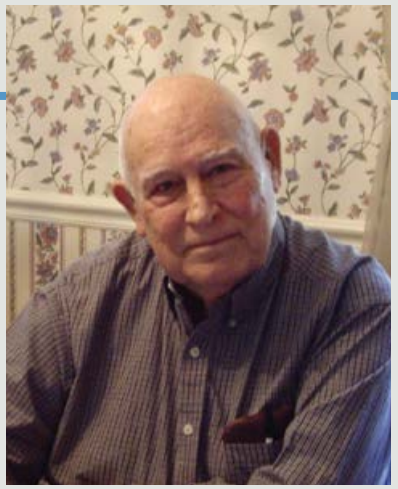
CERC's mission concentrated on coastal research. CERC became one of the world research institutes dealing with coastal processes. The formation of the Coastal Engineering Research Board at the same time provided oversight not only of the CERB but also any coastal related research being conducted at the Waterways Experiment Station (WES). This oversight of both institutions improved cooperation between the research activities occurring at both centers.

The CERC would develop its proposed annual and 5-year research program and submit to the Corps Director of Civil Works. Technical review of the proposed R&D program would come under Engineering at Corps Headquarters (Jacob Douma), but this was at high level. Detailed review of the proposed work and outcomes at the CERC would be done by the CERB. "Dean O'Brien and my father were pretty strong characters and had strong opinions that you needed to listen to! We would listen to them and include as we could. They recognized the need for field work as well as lab work. The CERB would be pushing for research long before we could do it." Originally the CERB members effectively had a lifetime assignment. The original members served for many years. Dr. Saville (senior) started in 1919 working on the BEB and continued to be active on the CERB until 1969. "There wasn't much change over, they got used to us and we got used to them. Not a lot of hassle."

The CERB meetings were largely a reporting process. CERC would organize and present its program and the accomplished research. The CERB would listen, ask questions and then go into executive session to discuss. Their report would recognize what was good and what should be different and then make recommendations. The military members were engaged in commenting and questions, with their focus primarily on the connection between the research and projects in their Divisions. They would often recognize the connection between the research and its impact to Corps projects. The CERB would generate ideas that the Director of Civil Works might or might not pursue. Even if a particular recommendation was not implemented, they still had significant influence at a high level.

What did the CERB do? The idea for the Field Research Facility (FRF, originally simply referred to as "the pier") came from the CERB long before it was built. "I think my father and O'Brien were the ones that instigated it back in the '60's." The pier was originally going to be built at Sandy Hook, then down in New Jersey, then on the coast of Maryland. Eventually a site in North Carolina was suggested by Rudy Savage (CERC Division Chief) and selected. The pier allowed us to track sediments and waves and how the patterns change with seasons and storms. It provided field data on water set ups from tides and waves. "It has tremendous capability to offer if it is used." The CERB members were also the source for the idea of developing Technical Report 4 (Shore Protection, Planning and Design) (TR 4), which was the first comprehensive shore protection guidance document. TR 4 evolved into the Shore Protection Manual, also at the urging and influence of the CERB. Ecological studies and research on coastal vegetation came out of the advice and guidance from the CERB. The CERB also helped to push the CERC to become more involved in activities with both the ASCE and the international coastal engineering community.

Author's Note: Mr. Saville passed away 5 November 2014



"Thank god I found coastal engineering. Never worked a day in my life…I enjoyed it so much."

John H. Lockhart, Jr.

(USACE Headquarters Technical Monitor, 1979–1997)

Mr. Lockhart was interviewed on 26 April 2013 in Fredericksburg, VA. Mr. Lockhart started his professional career with a petroleum engineering degree from Texas Tech. However, there were poor hiring opportunities in oil. Instead he was able to get a job working for the Fort Worth District of Corps of Engineers (August 1960). His first jobs for the Corps were working on hydrologic features of projects on the Brazos and Colorado Rivers in Texas and the Carr Fork reservoir in Tennessee. The start of ocean-to-ocean canal studies in Jacksonville District gave Mr. Lockhart the incentive to transfer to Jacksonville where he worked for 3 years, primarily doing Hydrology and Hydraulic (H&H) water routing calculations for the Central and Southern Florida Project water control studies. He learned his craft primarily by relying on engineering manuals. He would do hand calculations to check the outputs of the computer software routines. He was then approached by the Chief of H&H at the South Atlantic Division about moving to the Division (Atlanta). Mr. Lockhart started working on coastal projects by reviewing and checking coastal engineering studies prepared by the districts. He learned about coastal engineering through courses offered by CERC, consultation on projects with professionals from CERC, and by using Technical Report-4 and later the Shore Protection Manual. He also found that working with the CERB and meeting some of the giants of coastal engineering increased his education significantly. Some of his biggest projects were Ponce De Leon Inlet, Miami Beach, and the dunes at Wrightsville Beach. Hurricane Camille impacted the Mississippi coast (1969) during his watch. From 1972 to 1973 he attended Georgia Tech via long-term training and received his master's degree. In 1979 he was hired by Corps Headquarters to become one of the Corps leaders for coastal engineering. He retired in October 1997.

Mr. Lockhart's first involvement with the CERB was in 1968 in supporting his Division Commander. He attended most of the CERB meetings after that either as the Division POC or as the Headquarters Technical Monitor to the CERB. His first meeting was an interesting meeting in Miami when the concept of developing the Shore Protection Manual (SPM) was born. This document was then developed by CERB/CERC and first released in 1973. As the Headquarters Technical Monitor he would support the President of the Board, review all the

coastal reports, and provide guidance on the Research and Development program. One of his major accomplishments was pushing through engineering manuals to supplement the SPM.

By the time he had retired there were 11 coastal engineering manuals covering such subjects as shore protection structures (bulkheads, seawalls, revetments), near shore breakwaters, beach-fill, and sand-by-passing.

During the early stages of the Coastal Engineering Manual (CEM) development, he provided some input and review of the early chapters He also promoted the development of the Coastal Field Data Collection (CFDC) Program and the Monitoring of Completed Coastal Projects (MCCP) (now MCNP) to provide needed data to improve the craft of coastal engineering.

The CERB meetings were usually set up by the Executive Secretary of the CERB, who was the Commander/Director of CERC. Three Division Commanders and their staff support would attend each meeting along with three Civilian members and a number of people from the host District and Division. Attendees were almost all Corps folks. One memorable exception was the 1980 meeting in Buffalo District and the 1987 meeting in Savannah District when Orrin Pilkey addressed the Board. In the beginning of the CERB there was Thorndike Saville, Sr., Morrough P. O'Brien and Arthur Ippen. O'Brien had much to do with the development of TR-4 and Ippen developed the first numerical models of Chesapeake Bay. The Presidents of the Board would have to change hats as they filled the role of President of the CERB and then would return to their job as Deputy Commanding General for Civil Works. The Military members would generally rely on the Civilian members for technical insights. One major exception is when the CERB looked at Logistics Over the Shore (LOTS) and other military relevant topics.

What did the CERB do? "If it hadn't been for the CERB, CERC and the Corps, I don't know where we would be in coastal engineering in this country." The CERB is responsible for leading the way in moving coastal from an art to a science-based, engineering practice. The development of data sets suitable to drive analysis including reliable wave gages and the Wave Information System (WIS), (a computer hind-cast of wave climates for most of the U.S. coasts) changed the course of coastal engineering. Numerical simulation tools such as shoreline models (SBeach) and the data to support them have revolutionized coastal engineering. The CERB helped to set the course for Research and Development, promoted the development of guidance documents, and provided an additional forum to review coastal projects. "Engineers deserve a good review of their work."

Author's Note: Mr. Lockhart passed away 26 July 2015

"Some of the most famous people in the profession have served on the Board."

"I wanted to obtain guidance from these guys relative to the research program."

Dr. Robert W. Whalin

(Waterways Experiment Station (WES) senior researcher, CERC & WES Director, 1971–1998)

Dr. Whalin was interviewed on 5 June 2013 in Jackson, Mississippi, at Jackson State University. He grew up in Richmond, KY, and went to the University of Kentucky where he received a Bachelor of Science in Physics (January 1959). He then went on to earn a master's in physics at the University of Illinois (January 1961). He moved to California and worked first at Hughes Aircraft Co., Ground Systems Group, as a mathematician. That was followed by a position with Interstate Electronics, Corp., Oceanics Division, where they conducted contract work for the Office of Naval Research, Defense Atomic Support Agency and the Waterways Experiment Station (WES). He was recruited by Bernie LeMehaute (CERB member April 1982–July 1988) to work for the National Engineering Science Co. A couple of years later Dr. LeMehaute recruited Whalin to join a new firm he and three other partners were forming called Tetra Tech, Inc. While working on an explosive effects contract from WES, he was offered a position at WES with the opportunity to compete for long-term training that could lead to the completion of his doctoral degree. After 2 years in the Weapons Effects Division of WES (now part of the Geotechnical and Structures Laboratory) working on explosion-generated water waves, he applied for long-term training. In August 1971 he completed his doctorate in oceanography, with a minor in ocean engineering at Texas A&M University under Professor Robert O. Reid (CERB member August 1988–October 1992). Upon returning from long-term training he was transferred to the Hydraulics Laboratory to become Chief of the Wave Dynamics Division (WDD), replacing the retiring Robert Y. Hudson. In 1971 the WDD had only five other employees (two engineers, two technicians, and a secretary). It grew during the 1970s, eventually employing over 30 people.

The work of the WDD included studies on tsunami run-up, modeling of the Los Angeles and Long Beach Harbors, site analysis of proposed offshore nuclear power plants, design of perched beaches, and even studies of flood barriers to protect New Orleans from hurricane storm surges. They also developed some world class experimental facilities including the L-Shaped flume, a moveable bed basin, and a large-scale shallow water directional spectral wave generator. He was Chief of the WDD from 1971–1982.

In May 1982, he was selected to be Technical Director of CERC, replacing the retiring Thorndike Saville, Jr. At that time there was much of discussion about relocating CERC to Vicksburg and combining assets with the WDD. In December 1982 the move was confirmed by Corps Headquarters and became effective 1 July 1983. The "new" CERC in Vicksburg was populated with young, enthusiastic researchers, a high percentage with doctoral degrees. The Field Research Facility (FRF) remained at Duck, NC; however, additional on-site researchers were added to the staff, supplementing what had previously been largely operation and data collection technicians. The Research and Development direct funded program managed by the CERC at Fort Belvoir was added to the highly successful reimbursable program of the WDD to create a consolidated organization with a balanced basic and applied research program. Dr. Whalin was Director of CERC from May 1982 until June 1985, when he was selected to be Technical Director of WES. His involvement with the CERB was mainly during his years in Wave Dynamics Division and as Director of CERC (1971–1985). In 1998 he was selected to be Director of the Army Research Laboratory, a position he held until retiring as an Army civilian in 2003. After retirement he became Associate Dean (for Engineering) of the College of Science, Engineering, and Technology at Jackson State University (JSU). After a decade, that program has since lead to an accredited School of Engineering. He is currently a Professor of Civil Engineering and serves as the Director of the Coastal Hazards Center of Excellence funded by the Department of Homeland Security at JSU. He is also a voluntary Director Emeritus at ERDC.

His first involvement with the CERB was at the April 1971 meeting in Vicksburg. He had just come on board in the WDD and knew very little about the CERC other than familiarity with Technical Report (TR) #4. He gave an "eloquent" presentation on the Los Angeles-Long Beach Harbor model design. The Civilian Board members were Morrough P. O'Brien, Arthur T. Ippen, and Robert G. Dean. At the end of his presentation they started asking penetrating questions. That question-and-answer session led to a 1-year wave monitoring and measurement program and a pleasant, highly professional relationship with the CERB that lasted 27 years.

The CERB had a significant impact on the Corps coastal engineering research program. The CERB would be briefed on the R&D and would then critique what they had heard. There was a meeting at Fort Belvoir (1976) where every research work unit was briefed to the CERB. A few researchers were told not to continue with what they were doing. Both Civilian and Military members weighed in to the discussion. In the early 1980s the civilian appointments to the CERB were reduced to 3 years (renewable). A sequence of USA leaders in coastal engineering, that turned over an average of every 6 years, replaced what had previously been a few continuous members serving over a decade each. Only four civilian members served between 1963 and 1981. They had significant insight and had much influence on the Corps R&D programs.

What did the CERB do? During 1982–1985, as Director of CERC, Dr. Whalin oversaw the Board. Through the inflation years of the 1970s the dollar value of the Corps' research investment did not keep up with inflation. The investment in coastal engineering R&D was flat through the 1970s and started decreasing during the 1980s. Even though there was some funding for coastal science research invested by NSF, NOAA, USGS, and ONR, the Corps was the lead United States agency funding coastal engineering research. The result of decreasing investment was a decline in academic programs funded by CERC and an erosion of U.S. capabilities from the early 1970s on. During the early 1980s the civilian (LeMehaute, Dean, O'Brien, Weigel, Nummendal, Raichlen, Mei, etc.) and military members of the Board all did an outstanding job in providing advice to CERC and the Chief of Engineers. "Dean O'Brien used to say; 'Designing a jet engine is easy, designing a coastal engineering project is much more complicated.'"

"CERB was a way to get the ear of Corps leadership. Also the Civilian members were influential in their own areas"

"I really enjoyed the meetings. Can't think of another venue where you would get 3 civilians and 4 general officers together at that level of engagement on technical themes."

Dr. James R. Houston

(WES senior researcher, CERC & WES & ERDC Director, 1986–2010)

Dr. Houston was interviewed on 12 August 2013 in Jacksonville, FL. His undergraduate work was in physics at the University of California at Berkeley. He then went on to get a master's in physics from the University of Chicago. He was drafted into the Army in 1970 and assigned to the Waterways Experiment Station for his entire 2 years of service. At Vicksburg he was assigned to a branch in the Structures lab that was conducting research on waves generated by nuclear explosions. As a "free" asset, he was an off-the-clock asset to big projects with tight budgets and assigned to work with experimental field wave data. He had decided that after his military service was complete, he would go back to graduate school to work in engineering. Dr. Robert Whalin (then a Branch chief in the Hydraulics Laboratory) asked him what he was going to do when he got out of the Army. Whalin then proposed that he stay on and pursue applying for long-term training to support his graduate work in engineering. Dr. Houston took Whalin's advice and went to the University of Florida to work on a Master of Science in Coastal Engineering. He ended up with a doctorate in fluid mechanics and came back to WES to work in the Wave Dynamics Division of the Hydraulics Lab. The work load of the Division skyrocketed with numerous reimbursable protects. He worked on tsunami modeling (developing flood levels around the Pacific basin). This was the period when numerical modeling was just beginning, and he worked on numerical modeling of the Los Angeles-Long Beach harbor and Oregon Inlet, NC. The WES computational capability was only 32k of usable memory, so he would frequently fly to Los Alamos to use their "super" computers. (In fact, it was a regular journey for Wave Dynamics researchers to travel to Los Alamos from 1972 to the late 1970s to make model runs.)

He attended his first CERB meeting in 1976 when he gave a presentation on the tsunami work. The biggest names in coastal (Dean O'Brien, Bob Dean, and Bob Wiegel) were on the board.

It was a "scary" experience. Bob Wiegel was very supportive and stated "this is the kind of work we need to be doing!"

He attended some additional CERB meetings in the late 1970s through 1980s, but starting

in 1983, when CERB moved to Vicksburg, he went to all of the CERB meetings. He was a GS-14 researcher when CERC was relocated to WES and was not interested in going into management. However, no supervisors moved to Vicksburg with CERC, and Dr. Whalin (then Director of CERC) tapped Dr. Houston to take one of the two Division Chief positions that relocated. He was given his choice and chose the Research Division, which had a lot of direct research money and many interesting research projects. As Chief of the Research Division, he would give a presentation at each CERB meeting to provide an update of the research program. He was Division Chief for 3 years (1983–1986). In 1985, Dr. Whalin was selected as Director of the Waterways Experiment Station (WES), and Dr. Houston was selected as Director of CERC in 1986. This appointment was after interviews by LTG Heiberg (USACE Commanding General), which was quite unusual. However, as LTG Heiberg had been President of the CERB (1979–1983) he took a personal interest in this appointment and believed a coastal engineer should be Director of CERC. In 1996 the CERC and the Hydraulics Laboratory of WES were combined to form the Coastal and Hydraulics Laboratory (CHL) with approximately 250 employees. Dr. Houston was Director of CERC and then CHL for a total of 15 years. He attended every CERB meeting from 1983 to 2000. When the laboratories of USACE were consolidated into one center forming the Engineering Research and Development Center (ERDC), the Director position was at first slated to be at USACE Headquarters; however, eventually it was advertised as located in Vicksburg. Dr. Houston did not apply for the position, but in 2000 LTG Ballard, Chief of Engineers, asked him to become the first the Director of ERDC, a position he held until his retirement in 2010. In 2000, Thomas Richardson became Director of the CHL, and Dr. Houston stopped attending the meetings until 2006. "I probably attended more than anyone except John Housley (HQUSACE staff lead for CERB from 1963 to 1994)." Since his retirement, Dr. Houston has continued his research interests (i.e., climate change and sea level rise, the value of beaches, shoreline change, and beach nourishment), still attends some of the CERB meetings, and has an appointment as Director Emeritus at ERDC.

When Dr. Houston became Director of CERC, he thought the meetings of the early 1980s didn't make much sense. "They had no themes and no focus. A lot of the meetings were random stuff. Yet the CERB could be of real value to CERC." He and his Deputy, Charles Calhoun, decided to incorporate centralizing themes to get away from the minute research details and thus promote more strategic future discussions. They started to organize the meetings around themes with integrated meeting agendas. The first such theme meeting was the 1987 (November) meeting "Sea Level Rise," held in Savannah, GA. It is interesting to note that this meeting marked the 25th year of the CERB and set a new direction that dominated the next 25 years of the CERB. The CERC and the CERB have had a big impact on coastal engineering. For example, the SPM became the internationally recognized bible of coastal engineering, used by universities throughout the world and translated into numerous languages. The CERB has also had much impact through the theme meetings. At the Fort Lauderdale meeting in 1990, the theme was Coastal Inlets. The USACE HQ Chief of Programs said, "If there is an area where you could save money, it would be coastal inlets." Three years later there was a Coastal Inlets Research Program, and that research program continues to today.

At a 1995 meeting at the University of Florida (CERB working group led by Dr. Bob Dean and MG Milton Hunter (NAD, Sep. 94–July 97)) they were working on developing a strategic plan for coastal engineering into the twenty-first century to then be presented to the CERB. MG Hunter came into the meeting and said the administration was "…no longer in the shore protection business." (USACE funding for coastal shore protection projects was no longer to be budgeted). That put a damper on the now-shortened meeting, and Dr.

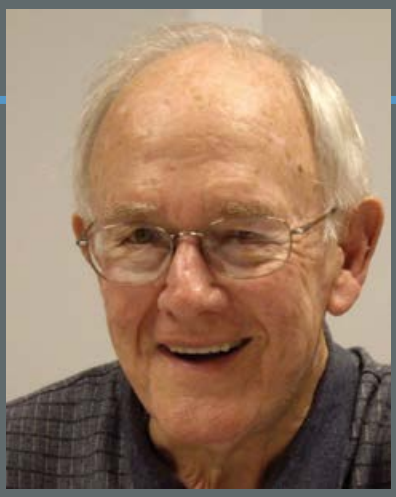
Houston was prompted to determine a way to illustrate the federal interest in, and the value of, beaches. This work was first published in 1996 and has since been updated and published in journals four times. Dr. Houston's work on this topic has been presented to the coastal caucus of Congress and used as a benchmark for promoting continual national interest and federal investment in beaches. This work, prompted by the CERB, "...has had a lot to do with keeping the Corps involved in the beach business." The 1998 meeting in Fort Lauderdale, FL, was the first meeting with the theme of Regional Sediment Management (RSM). From this meeting spawned the entire concept of RSM which lead to the funding of a demonstration project through the Mobile District, and then application throughout the Corps (not only for coastal projects, but also for watersheds). RSM is a stewardship management approach that is now recognized through the Federal water resources community as a logical approach to conducting water related activities.

Until Dean O'Brien (1963–1980) retired from the CERB he practically dominated the meetings. He used to make the major R&D decisions. After 1980, CERB went through a short period of being lost. Starting in the mid-1980s the CERC (and subsequently other areas of the R&D program) formed and used Field Review Groups (made up of senior coastal engineers from various Districts and Divisions) to review the research and make decisions on priorities. The FRG priorities tended to be more applications oriented. On the other hand, the CERB would support the conduct of more basic research. Having the CERB civilian members attend the program reviews worked out beautifully. The CERB would hear the FRG comments and note the need for more practical research. Meanwhile the FRG folks would listen to the CERB and promote the need to incorporate basic research. The result was a fairly well-balanced research investment plan. The CERB civilian members were very much engaged in the coastal R&D program. However, after the 1995 administration's dismissal of Federal interest in the coastal shore protection mission the "Coastal R&D Program" lost its identity and the research has become dispersed over several research activities. Subsequently the CERB has become more engaged in USACE policy. Until his retirement in 1994, John Housley would take the lead for putting together the meeting agenda. He would get with people from some of the Divisions to work on the agenda and negotiate what would be presented by whom. It was a very interactive process for developing R&D priorities. When Charles Chesnutt took over as HQUSACE staff lead for the CERB the meeting agenda tone changed. The meeting became less technical and more oriented around policy issues and interagency coordination. There were more presentations by NOAA and USGS researchers and many fewer by USACE researchers. That has since changed, and since the early 2000s there are still research presentations by other agencies and by academics or state officials, but there are more USACE R&D activities included in the agenda. However, with the present R&D priority development model in USACE, not only is the coastal engineering research distributed within the business area framework and programmatically invisible, but the recommendations of the CERB do not have a direct path for influencing research priorities. Currently R&D priorities are established by USACE Headquarters staff.

What did the CERB do? The CERB had much to do with the development of the SPM, inlets research, the Corps R&D process, RSM, and in setting the direction for coastal engineering research for 50 years. The CERB also was involved in recommending the transition of CERC from its Fort Belvoir location to Vicksburg and incorporation into WES. Until the 1980s CERC did not have to pay Plant Replacement and Improvement Program (PRIP) and would testify on their program directly to Congress. Consequently, coastal research was a much larger percentage of the Corps R&D program. However, once CERC moved to Fort Belvoir, coastal R&D direct funding went down, and they were required to pay PRIP. CERC could not afford to continue with the same business model. However, the management and staff were not keyed into conducting reimbursable work and had not developed the marketing skills for working with USACE District offices. Meanwhile the Wave Dynamics Division at WES had a booming program with some important advancements in laboratory facilities, funded primarily by a diverse customer base. The CERB visited Vicksburg in November 1981 and reviewed the WES business model. LTG, then MG, Heiberg was President of the CERB (1979–1983) and, with the recommendations of the CERB, made the decision in 1982 to move the CERC to Vicksburg.

Through the CERB, Dr. Houston developed relationships with the civilian members that continue today. He has become friends with these researchers and they have kept him grounded in his professional interest in coastal engineering. He met some outstanding General Officers. The General Officers and the civilians treated each other with much respect, listened to each other, and learned from each other.

Miami Beach, Florida



"The Presidents of the board and the members took the CERB very seriously and that had significant impact. We had commanders that requested that they be on the board."

"It was fascinating to see what could be accomplished."

Charles C. Calhoun, Jr.

(CERC Deputy Director and CERB Staff Support, 1985–1999)

Mr. Calhoun was interviewed on 4 June 2013 in Vicksburg, MS. He grew up in Brookhaven, MS, and received a Bachelor of Science in Civil Engineering from Mississippi State. He began working for what is now the Geotechnical Laboratory at the Waterways Experiment Station (WES) in June 1963. "WES was like an engineer's ticker toy…tremendous experience." He earned a Master of Science specializing in Geotechnical Engineering from Oklahoma State University through the WES long-term training program. In 1973, he moved to what is now the Environmental Laboratory where he was to be the engineering member of the new Dredged Material Research Program (DMRP) management team. At the conclusion of the DMRP he headed the umbrella program for all dredging work in EL. Then, in 1985, he was selected to be the Assistant Director of CERC. CERC later joined the Hydraulics Laboratory to form the Coastal and Hydraulics Laboratory. Thus he worked in three different labs and as Mr. Calhoun put it, "My career got wetter and wetter." He represented CERC at his first CERB meeting before he was actually onboard at CERC. When he retired from WES, Mr. Calhoun conducted leadership and ethics seminars through ASCE.

When Mr. Calhoun came to CERC, he had some familiarity of the CERB from his dredging R&D experience; however, he quickly realized that the list of board members was very impressive and that the CERB was an organization that had impact. With a relatively small R&D coastal budget, the General Officers on the Board gave the field of coastal a high level of visibility in the Corps. A number of the Board Presidents went on to become Chief of Engineers and there was continuity with some of the Chief's Charges to the Board. The military members used to be commanders for longer periods and consequently would serve on the board for longer periods, thus they could have a greater impact. The President of the CERB could go back to HQ and change his hat to Director of Civil Works where he could make things happen.

Mr. Calhoun spent a lot of time working with the CERB. He kept up with the Action Items and worked to make sure actions were accomplished. In addition, he worked to develop topics, themes, and agendas. This involved working with the Director of CERC (Dr. Robert Whalin, and later Dr. James Houston) and with the Headquarters team (including John Housley, John

Lockhart, Bill Murdin). Overall, the CERB provided entry into the upper levels of the Corps and an opportunity to work with the Corps leaders to improve the field of modern coastal engineering that the Corps founded.

Some of the earlier Board meetings were smaller with usually just the Board members, and Headquarters, WES, and host District representatives attending. Later meetings, especially once themes started to be used, become larger with more attendees from outside the Corps. The first of these big meetings was the Savannah meeting that had the theme of Sea Level Rise (November 1987). It became a priority of the meeting agendas to include other agencies and partners. Once themes were developed for the meetings, it became easier to assemble the meeting agendas. The theme was usually developed from the previous meeting, then a draft agenda would be reviewed with the President of the board, and a committee would start listing presentations and topics. The host Districts and Divisions would add topics and presentations of particular interest to them. The civilian members would weigh in with recommendations on presentations. At this time there were two full meetings a year, and the work load was very intensive. Action Items came from the board and had to be addressed. Task groups were formed, and things would happen. MG Hatch "was a dynamo" who would set priorities for the CERB. The field trips would be germane to the meeting and were really eye-opening experiences. MG Hatch ran a tight meeting and would identify Action Items during the course of the meeting. This approach became the norm for future meetings.

Mr. Calhoun attended all the CERB meetings from May 1985 to October 1998. The Generals were all outstanding, and the Civilian members were the leaders of the profession. Although sometimes they were of strong opinions, the board of seven individuals would even out the issues. There was great credibility to the board and its members. The Civilian members would help the Generals understand many of the highly technical details, and the Generals understood the real-world challenges.

What did the CERB do? Many things came out of the CERB. The CERB helped to streamline the process of getting some needed big programs going including the Dredging Research Program and growth of Field Data Collection. CERC U (the Corps graduate education program with Texas A&M that lead to a master's in coastal engineering) came directly from the CERB. MG Hatch (when President of the CERB) made a comment that he could describe the major problems he had in coastal to three words: "Inlets, Inlets, Inlets." That concern lead to the formation of the Coastal Inlets Research Program. Other programs and activities that were directly supported by the CERB were the ACES Program (Automated Coastal Engineering, the first "APP" style software that automated routines from the Shore Protection Manual (SPM)). Regional Sediment Management (RSM) was very popular with the Division Commanders as they could see the value in working beyond limited project specific focus.

"Congress knew we needed to develop a technical capability in this country [in coastal] that did not exist and that is why they created the CERB. We are promoting the orderly construct for the coast."

Charles B. Chesnutt

(USACE Headquarters and Institute for Water Resources Technical Monitor, 1993–present)

Mr. Chesnutt was interviewed on 21 May 2013 at Fort Belvoir, VA. He grew up in a small town in south Texas loving the occasional family visits to the beaches on Mustang Island. When he enrolled in Texas A&M to study Civil Engineering, he learned of a new field being stood up at Texas A&M called "coastal engineering." Some enthusiastic coastal and ocean engineering teachers captured Mr. Chesnutt's interest. He completed his Bachelor of Science in Civil Engineering in January 1970 and continued to complete a master's in ocean and coastal engineering in May 1971. Mr. Chesnutt conducted his graduate research on scour in front of sea walls but also did field work working alongside a fellow graduate student in oceanography, Curt Mason. Curt Mason was going to be interviewed for a position at CERC. Mr. Chesnutt, and Dr. Bob Sorenson also were interviewed at the same time. Mr. Chesnutt was offered a temporary position with Dr. Cy Galvin from April to August 1971. In August, Mr. Chesnutt had to report to the Army to complete his ROTC requirements for engineer officer training at Fort Belvoir. He was on active duty for his 3 months of training, but the Army was cutting back and he was assigned to the reserves. Mr. Chesnutt then returned to CERC for a permanent position running and analyzing laboratory experiments on beach profiles, specifically to understand scale and laboratory effects. He started with CERC at the Dalecarlia Reservoir in NW DC where they occupied old World War II buildings. In 1973, CERC moved to the Kingman Building at Fort Belvoir. The laboratory effects experiments were done at the Dalecarlia facility over a 3-year period, but the analysis was completed at Fort Belvoir. They found that flume temperature affected sediment movement and wider flumes introduced laboratory generated 3-dimensional impacts.

After 8 years at CERC (in 1979), Mr. Chesnutt had the opportunity to go to Clemson University for a year to teach coastal engineering while Dr. Billy Edge was on sabbatical. Then in 1982, he was offered a position at Corps Headquarters to work in Flood Plain Management. He was brought on to become John Housley's replacement, but instead of retiring in 1984, Mr. Housley continued to serve as the Headquarters Coastal Planning lead until 1994. Between 1984 and 1994, Mr. Chesnutt worked on Flood Plain Management, Planning Assistance to the

States, and Hurricane Evacuation studies. In 1994 Mr. Chesnutt became the Corps Headquarters Planning lead for coastal and staff lead for the CERB. In 1999, when Mr. John Lockhart retired, he became the Headquarters primary point of contact for coastal programs.

The first meeting of the CERB that he attended was as a CERC researcher in Wilmington, NC (1974). In May 1976, the CERB came to Fort Belvoir and conducted a complete program review of CERC's R&D program. Presenting your research to the CERB "…was a big deal. Bob Dean, Dean O'Brien, Bob Weigel!… You treated these guys with real reverence." The civilian members "subcommittee" would meet frequently with CERC staff and with Districts to review research plans and also help in designing projects. They helped in designing the jetties at Murrells Inlet, the Field Research Facility, and the experimental groin in California. In 1987 he attended his first CERB meeting as a Headquarters employee: theme of Sea-Level Rise, Savannah, GA. Since 1993 (Mobile, AL) he has attended every CERB meeting except one. The only significant change in the format of the meetings is when the board moved from a theater style to a U-shape to better accommodate slide and eventually PowerPoint presentations. Attendance at the meetings used to be all Corps. However, the meeting in Savannah seemed to change that, and after 2002 the Board really wanted to hear from those outside the Corps.

Three different studies were being done at one time: 1) NRC study on how beach nourishment was working, 2) Section 309 looking at coastal management and connection to Corps projects, and 3) an OMB-directed study on Corps beach nourishment projects which lead to the "Purple report." These all were completed in 1995. MG Stanley Genega appointed MG Milton Hunter (NAD) and Dr. Bob Dean to develop a strategic plan for improving the conduct of beach nourishment and coastal engineering generally in the Corps. With a small staff they developed an 11-point strategy. This was presented at the June 1996 San Diego board meeting and led directly to the Board's endorsement of a systems approach in managing coastal projects.

In the 2000s there was a phenomenally good board that jelled very well. Both the civilians and the Division Commander members were energized and dynamic. MG Griffin was the President. The big topic that the board supported was "DATA," and the CERB promoted the need for the Corps to be involved in the Integrated Ocean Observing System (IOOS). The Board "...became drivers in Corps HQ for the need to be involved in data collection and integration. These board members energized and pushed the envelope on where the Corps was going on data collection." The Corps became more involved in not only the federal framework for data collection but also in issues of national ocean policy and developed a much stronger relationship with NOAA. Due to financial considerations, the board meetings were cut from two full meetings a year to one meeting a year plus a smaller executive session. The Board also became less involved in reviewing District projects and reoriented to looking at strategic directions. The CERB was the source for taking a systems approach and developing the concept of Regional Sediment Management (RSM). Both the civilian and the military members understood the significance of RSM. A demonstration project started in South Atlantic Division (SAD), Mobile District. "The civilians have always been the strength of the board, but when the military understands the significance of what the civilians are advising and buy into it, things really happen!"

What did the CERB do? The CERB gives the area of coastal engineering in the Corps a real leg up and higher level visibility amongst Corps leadership. Two major contributions of the board have been the recognition of interagency collaboration particularly in the importance of data and in developing the systems approach.

"If you do your homework…the CERB was a vehicle not just for review, but to help in moving good research ideas forward. Not many groups had this opportunity to have face to face time with leadership…"

"Leadership and General Officers don't have many opportunities to have a dialogue with working level people on complex issues."

Thomas W. Richardson

(Coastal and Hydraulics Laboratory Director and CERB Staff Support, 1999–2009)

Mr. Richardson was interviewed on 5 June 2013 in Jackson, MS. He grew up in the Long Island region of New York, enjoying early childhood memories of beaches, fishing, and salt water adventures. When he was 12 the family moved to South Carolina where he had an opportunity to spend time at a lowland coastal plantation enjoying the shore and further confirming his interest in the ocean. He received his Bachelor of Science from the Citadel (Military College of South Carolina) where his senior project was a study of siltation in Charleston Harbor. Through that study he became familiar with the work of the Waterways Experiment Station (WES) and used some of its data. He was commissioned in 1968 but was interested in ocean engineering and was able to get his military service deferred, allowing him to attend the University of Miami, earning a master's. He went on active duty in 1971. His first assignment was with the Far East District of the Corps of Engineers in Seoul, Korea. June 1972 he was transferred to WES. In 1974 he completed active duty and was hired as a civilian at WES working in the Estuaries Division of the Hydraulics Laboratory as a researcher. He received a Diploma in Hydraulic Engineering from the International Institute for Hydraulic and Environmental Engineering in Delft, the Netherlands, under the WES long-term training program in 1979. In 1983, when CERC moved to Vicksburg, he was selected as a Branch Chief. Eventually he became Division Chief, Assistant Director, and then Director of the Coastal and Hydraulics Laboratory. He retired in January 2009 and in February started working at Jackson State University Department of Homeland Security (DHS) Center. He now works full-time at the DHS "Coastal Hazards Center of Excellence" at Jackson State.

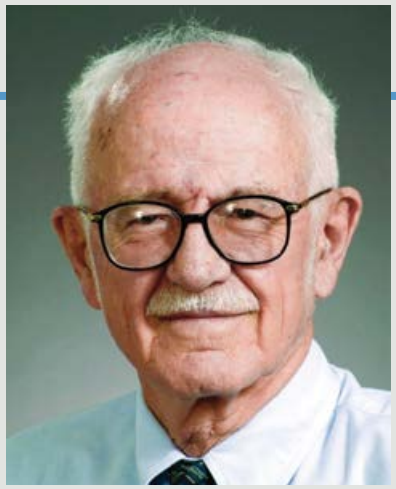
During his career at WES, Mr. Richardson had major roles in developing the airborne LIDAR bathymetric surveying program, Core-loc as a new coastal armoring unit, the Silent Inspector that improved dredging monitoring, and Regional Sediment Management (RSM). RSM ties a lot of disparate things together to the betterment of the nation. These programs exemplify the potential to work entrepreneurially within the Federal government to research and develop significant advancements that can be seen within one's career. All of these programs got their start via presentations and dialogue with the CERB.

The first CERB meeting Mr. Richardson attended was in 1975 in San Diego. Until 1983, when he became a Branch Chief at CERC, he had only occasionally dealt with the CERB as a researcher presenting some of the work he had been doing on sand by-passing and dredging equipment. During that period the CERB was very technically-oriented with all the civilian members from academia. The CERB tended to be involved in reviewing projects in the local districts and CERC research activities. As the Corps has evolved from a technology focus to more of project management, the CERB has also changed reflecting the Corps evolution. The biggest change was in the late 1990s when the civilian members were selected to reflect a boarder spectrum then just the academic sphere (academic, industry-private sector, others). It was this composition of civilian members on the CERB that really saw the value of RSM. As a Branch Chief and later as a Division Chief, there were research programs they were trying to develop. "If you were smart you ran these ideas by some of the civilian members, then eventually pitched them to leadership. The goal was not to by-pass the bureaucracy, but rather streamline the process to move good ideas forward."

"The CERB both led and reacted to culture changes in the Corps. The CERB of today is not the CERB I saw in 1978." In the mid to late 1980s the CERB evolved and started to reach out to bring in more non-Corps entities to make presentations and attend the meetings. This reflected the needs of the Corps to also reach out to other resource agencies in dealing with complex water resource issues. A milestone meeting was the 1998 meeting Fort Lauderdale, FL. This meeting was the first time the Corps embraced the idea of managing at a regional scale. Another critically important meeting was the 2007 fact finding trip of the CERB to the Netherlands. That meeting allowed the CERB to talk to officials and researchers from several nations of the European Union about both coastal and riverine water resource management issues.

The planning for each meeting started in the previous meeting's executive session. The Board would decide on the meeting location and develop some ideas as to the theme. The theme would be better defined and worked into an agenda with the HQ proponents and the host District and Division. The agenda would include a mix of research inside the Corps and also with other Federal agencies and academia. A draft agenda would be developed and coordinated with the President of the Board before being finalized. Sometimes the civilian members would provide input on specific presentations or subjects for inclusion. The first themed meeting was the 1987 meeting in Savannah on Sea Level Rise. Before that the meetings tended to be disparate subjects. Much work goes into organizing the meetings and much of what comes out of the meeting comes out during the down time between presentations and after hours. Some Commanders who have served on the Board have gone on to become President of the Board, and some Presidents of the CERB have gone on to be Chief. Leaders such as LTG Heiberg, Strock, Van Antwerp, and Hatch have each served on the CERB and either came back to the CERB presenting a "Chief's Charge" or took ideas from the CERB to more generic application such as RSM and professional education of USACE employees.

What did the CERB do? The Corps is responsible for coastal engineering in the United States. The Corps invented coastal engineering as a profession in the 1920s. Anything done in the Corps related to coastal issues and projects, influences coastal in the United States and the world. The primary guidance for coastal was Technical Report #4 (TR-4), then the Shore Protection Manual. There are other institutions in the world that are doing coastal research, but the Corps R&D is tied directly into engineering practice and applied to projects. The CERB had oversight of that mission, and therefore everything the CERB did had impact to coastal, the Corps, and the world.



"Always impressed with the generals. Appreciate and recognize the capabilities of those individuals to carry out their roles and their level of energy."

"I felt we provided benefit to the program and also to the individual researchers."

Dr. Robert G. Dean

(CERB Civilian Board Member, June 1969–June 1981 & November 1993–April 2000)

Dr. Dean was interviewed on 13 August 2013 in Gainesville, FL, on the campus of the University of Florida. He was born 1930 in Laramie, WY, and grew up in a small community in northern Colorado (Walden, CO). His father died when he was very young, and the family struggled to make ends meet. When he was 12, they moved to Long Beach, CA. He originally was aiming for training in vocational skills but did well on tests and was encouraged to go into engineering. After 2 years in community college (Long Beach City College) he was accepted at the University of California at Berkeley to pursue a degree in civil engineering. He worked during the school year (running calculations for his professors) and summers (forest fire fighting). Professor Joe Johnson was assigned as his advisor and Dean Morrough P. O'Brien (CERB civilian member 1963–1980) was the Department Dean. In 1954 he received his Bachelor of Science in Civil Engineering and while looking for a job, Joe Johnson intervened and helped him to get a fellowship at Texas A&M working with Prof. Robert Reid (CERB civilian member 1988–1992) and Prof. Basil Wilson. His thesis work involved studies of forces on pipes and cylinders in a wave tank under conditions of tow. He was awarded a master's in physical oceanography in 1956. He then went to Massachusetts Institute of Technology working with Arthur Ippen (CERB civilian member 1963–1974) measuring stresses on underwater plates and cylinders while he also pursued a doctorate in civil engineering (1959).

After receiving his Doctor of Science degree he taught at MIT for a year and then was hired by Chevron Research Corporation (a unit of Standard Oil) for a position in California. He worked with them for 5 years, primarily on nonlinear wave theories, forces on piles and wave loadings. Much later CERC provided funding to develop tables of wave theory solutions and pile loadings. Although the work at Standard Oil was interesting, they had limited authority to publish due to the industry proprietary nature of the work. He then went to the University of Washington and taught courses in the Department of Oceanography for a year. In 1966 he was accepted for a position at the University of Florida in the Coastal and Oceanographic Engineering Department. He worked there for 9 years with Thorndike Saville, Sr. and Dr. Dean found himself spending much of his professional energy studying the beaches of Florida. He was impressed by the coastal geology book written by Douglas Johnson and became fascinated with coastal geomorphology.

In 1975 he went to the University of Delaware. He worked with Dr. Tony Dalrymple and Dr. Hsiang Wang and became more involved in working on Sea Grant and nearshore sediment transport programs. He was hired as a consultant for Bechtel and Exxon and had opportunities to become involved in projects throughout the world. In 1982 he returned to the University of Florida. Dr. Dean retired in 2003 and was appointed Emeritus at the University of Florida where he continued to conduct research, consult, and write.

Dr. Dean served on the CERB during two separate appointments, a total of 18 years. He was first appointed in 1969 replacing Thorndike Saville, Sr. O'Brien and Saville had told him about the CERB. His initial perception was that the military was more direct and would assure that things would be done on time. They were very smart people and would often make their own observations of coastal features. During his assignment to the CERB he worked on several key projects that led to major CERC programs. He worked with Dean O'Brien on the outline for the Shore Protection Manual (SPM) and developed some of the technical details. He also worked with Bob Reid and Leon Borgman in overseeing and developing recommendations for the Wave Information Study (WIS). Dr. Dean remembers recommending that CERC should become involved in numerical modeling when much of the research was focused on using physical facilities and field studies. The CERB has a very well developed program of full member meetings. In between, the civilian board members would get together in some less structured meetings. Some of these meeting involved reviewing the CERC R&D program and providing recommendations and opportunities for how the research might be further developed. During this period most of the research was done in-house at CERC and the CERB civilian members would get more personally involved in some of the research details. As the CERC program become more complex with more external contractors, it was harder to provide detailed recommendations. So the CERB started to look more toward the broader issues. The CERB Civilian member meetings would be formulated during the full meeting and then the results reported back to the full-board as both written and presented recommendations.

The CERB used to be more involved in reviewing Corps projects. When presentations would be made to the board on a project, the CERB would develop recommendations on the future directions of these projects. An example is when the Board recommended that breakwaters should be developed as an approach for managing the erosion on Presque Isle, PA. But projects seemed to have become broader and expanded with the technical engineering issues no longer primary drivers of the solutions. The CERB Civilian members were very involved in reviewing and designing aspects of the 1984 update to the Shore Protection Manual. The Board members also had a fair amount of influence on the meeting agendas, although generally the agendas were developed by the CERC director. Dr. Dean worked with MG Milton Hunter (NAD Commander and CERB Member) on an initiative in response to interest from industry for the CERC to help United States industry into developing international connections (Japan, Canada, etc.) and further to help to open the door for USA work with developing countries. Unfortunately, that initiative could not go very far.

As the focus of the CERB became broader, the board became very involved in developing the concept of Regional Sediment Management (RSM). The board expected RSM to lead to a revolution in USACE projects as the concept was understood and applied. The board expended a lot of energy on RSM, and to some degree it has been successful. Other areas that the Board worked on, but could use more work, are in managing sediment at inlets and in addressing the problems of eroding shores. There are problems like this that were recognized by the Board, but much more effort beyond the reach of the Board is needed. The CERB, at least, would attempt to provide some attention and quantify the degree of the problem, and would raise the issue to USACE leadership.

What did the CERB do? Documents developed through the CERC and the CERB have been invaluable to coastal engineering in this country and also to the international community. The influence of the CERB has international impact. Other countries (such as Spain and Japan) have developed their own coastal engineering manuals, but it is the view of coastal engineering and the principles developed by the Corps that is the main contributor to the practice of coastal engineering, in both the USA and abroad. Much of the early work in coastal engineering was done by the staff of the Beach Erosion Board (BEB) and then carried forward by CERC. These data sets and relationships behind such basics as wave prediction and storm surge estimation are still valid. A lot of the practical work recognized by the CERB and addressed by the CERC came out of problems identified by the Corps Districts. Examples are Core-loc and sediment transport computational tools.

Author's Note: Dr. Dean passed away 28 February 2015

St. Lucie Inlet, Florida

Captiva Island, Florida

"Mission on the Board was to provide guidance to CERC on research. The CERC was very responsive to suggestions. Second tier was to provide guidance to Generals and Corps leadership. That didn't happen enough."

"If you would like me to serve again on the Board, I'd do it again. It was a wonderful experience, good for my career, and I learned a lot."

Dr. Robert A. Dalrymple

(CERB Civilian Member, September 1989–October 1993)

Dr. Dalrymple was interviewed on 3 June 2013 at John Hopkins University in Baltimore, MD. He grew up in the United States Air Force with many family moves, but with some enjoyable times spent on New Hampshire beaches. His father had taught ROTC at Dartmouth College and both his grandfathers had gone there, so he attended Dartmouth for his undergraduate degree, majoring in engineering. He then attended the University of Hawaii and received a master's from their new program in ocean engineering. He was able to get a job at the University of Florida in 1968 as a Research Engineer working with the Coastal and Ocean Engineering Program. As a full-time employee he could take classes and, with Dr. Robert Dean as his advisor and some funding through the oil industry, he was able to complete his doctorate after 5 years (1973). His research was in offshore waves and currents.

He was hired for a position at the University of Delaware where they were building a new interdisciplinary coastal and ocean program. After several hires and departures, the University of Delaware eventually developed one of the two or three strongest coastal programs in the USA, with a focus on coastal engineering. During his 29 years at the University of Delaware, Dr. Dalrymple founded and directed the "Center for Applied Coastal Research," which has significant visibility in the profession. Many of their students have become the current leaders in coastal engineering, including a strong contingency of today's coastal modelers. Through the Center they developed some industry standard open-source coastal models. He started the "Coastal_List" (an international communication network) and developed a suite of web-based teaching applets. Dr. Dalrymple's research has focused on nearshore hydrodynamics including tidal inlets, rip currents, and waves. Over the years most of his research had been funded by the Army Research Office, Office of Naval Research, with some and the NSF support as well.

In 2002 he moved from the University of Delaware to John Hopkins University. Although it was a step back in terms of coastal engineering research facilities and academic program depth, his departure did force the University of Delaware to reshape their program for the future and also allowed Dr. Dalrymple to focus more on areas of specific research interest. In conjunction with national and international professional colleagues, his current research includes investigating waves over mud, and developing numerical models for waves specifically based on particle motion simulation. Dr.

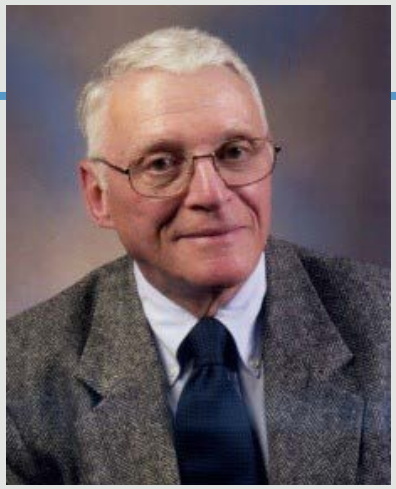
Dalrymple sees "…the laboratory tests, research, and numerical solutions that they are developing today will lead to the applied coastal engineering modeling tools that will be in practice in about 10 years."

Dr. Dalrymple had learned about the CERB from Dean O'Brien and Dr. Bob Dean. He knew the Board was populated by well-respected coastal engineers. However, he had not attended a meeting before he was asked to serve in 1989. He found the CERB to be a good source of information flow in both directions. Prior to serving he had a reasonable idea of the Corps, had used TR 4 in graduate school, and had found the CERC reports to be very important source material for coastal engineering, However, on the Board he saw a much broader range of what the Corps was doing and had a better chance to interact with engineers and scientists at WES. It was interesting to be treated like a General Officer when sitting on the board, "a whole different experience." "…part of my job was to educate the Generals on the engineering and science issues. From them and the field trips, I learned about the real world problems and legal issues. It was a good compliment." They would get into some interesting discussions with the General Officers. The Civilian Members were interested in the discussion on the science. But the Military Members emphasized the need to make a decision. "I learned a lot from these guys. They have to make decisions and move on. They were actually pretty spectacular individuals and had amazing personalities." Prof. Bob Reid and Dr. Fred Raichlen were the other Civilian Members. "Both terrific and respected individuals." The Civilian Members also went to CERC and did a "deep-dive" into the research providing for one-on-one discussions with the researchers.

Early in his career WES and CERC funded more academic work, which served as, a useful exchange between academic and the Corps labs. "That was not true later in my career as funding for academics dried up. On the other hand, the FRF was a valuable asset for obtaining field data.. No doubt, some of my research has been positively affected by relationships with the Corps." Dr. Dalrymple helped to get the CERB field trips back in the air in helicopters. "The helicopter trip of Hawaii was amazing and very informative." They saw a lot of the United States coast including ports, breakwaters, high energy west coast harbors, and tidal inlets of New Jersey. Issues Dr. Dalrymple particularly emphasized while on the CERB were the need for the Corps to take more responsibility for downdrift erosion effects at navigations structures. Lists of inlets were prepared and some work, particularly through Section 111 studies continued. One of his biggest concerns was that a lot of work was going into adding new capabilities onto old technology models (i.e., GENESIS), while he felt the Corps should be investing more in developing true three-dimensional capable models. He felt CERC was not aggressively pursuing new technology and the Europeans got ahead of us. He feels that in the early 1990s the United States was not investing in United States research in model development and any development was piecemeal resulting in a loss in United States capabilities. "The United States exported the foundations of the technology, but United States 3-D coastal modeling got left behind."

What did the CERB do? Through the CERB some lifelong professional collaborations were made and developed. Since having left the CERB, Dr. Dalrymple maintains more interaction with CERC, and many of his students have gone to work at CERC. "The value of the CERB is it helps to keep CERC from becoming too inwardly focused on their own research. CERC needs external strong ties into the technical universities. Unfortunately as funding has dropped, connections with the universities and therefore the cutting edge quality of the work drops."

When the Board raised questions, they always got answers. "We influenced the Generals and what they carried with them and I think we influenced some of the research at CERC." Serving on the Board has helped Dr. Dalrymple in his career after leaving the Board and facilitated additional professional opportunities. When he served on an ASCE inspection team reviewing Hurricane Katrina damage in New Orleans after the storm with Corps teams, he had a much better insight into how the Corps operates, and it gave him a much broader experience base to address the complex issues associated with the coastal engineering for natural disasters.



"...the meetings and my membership on the CERB were a good personal experience."

"All the tours were very well planned in showing us the projects and what the Corps is involved in. It was an education to me and contributed to the members."

Dr. Fredric Raichlen

(CERB Civilian Board Member, September 1989–October 1993)

Dr. Raichlen was interviewed in California on 17 July 2013 via phone. He was born and raised in Baltimore, MD, and attended Johns Hopkins University for his undergraduate studies in civil engineering. He then completed his master's at Massachusetts Institute of Technology (MIT) in 1955 working with Dr. Arthur Ippen (CERB member 1963–1974). He entered the United States Air Force and completed his military service in 1959 as a 1st Lieutenant. During his 3 years of service he was stationed in Sacramento, CA, and Eglin Air Force Base, FL, as both a sanitary engineer and as a "noise officer," (measured the noise behind jet planes). After his military service he returned to MIT and again worked with Dr. Ippen, completing his Doctor of Science degree in January 1962. His research and dissertation were on harbor resonance. He stayed on at MIT for another 6 months as an Assistant Professor before accepting a position at California Institute of Technology (Caltech) in the summer of 1962. He remained at Caltech until his retirement in July 2001. His major research topics included harbor resonance, breaking waves, tsunamis, harbor and bay transient waves, forces on vertical structures, ship waves, and underwater landslides. He is still associated with Caltech as a Professor Emeritus and does some consulting and writing.

Dr. Raichlen has consulted on a broad array of professional subjects related to civil, coastal, and ocean engineering. For example, he has conducted work on the armoring of submarine outfalls, the physical modeling of coastal processes, and on the run-up of breaking waves among other coastal and hydraulic topics. One interesting project was evaluating wave generation and propagation in support of the design for the "Typhoon Lagoon" at Disney World®. He worked with CERC on wave resonance in Long Beach Harbor and conducted some work in the CERC large wave tank. He had his first involvement with the Corps' research community in the early 1960s when WES (Robert Hudson) sponsored research on wave-induced motion of moored small boats. In the early 1990s he worked with CERC on wave resonance in Long Beach Harbor. In addition, he and his students used the CERC large wave tank to study certain aspects of the run up of breaking waves on a sloping beach.

His first experience with the CERB occurred when he was asked to serve on the board in 1989. He had little exposure to the CERB before then. His first meeting was at Redondo Beach, CA

(October 1989) and his last was in Honolulu, HI (October 1992). Involvement in the CERB helped him to develop a better insight into the CERC and its research programs. From his visits to CERC he has developed some continuing professional associations with CERC researchers. Although the meetings included tours of different beaches and parts of the coast, the real education was in seeing the coast from the air. Some observations from the air triggered research interests that Dr. Raichlen took back with him to work on at Caltech. Examples are the wave breaking characteristics observed at Atlantic City, NJ, that led to his continuing research on breaking waves and research interactions with CERC.

Other than with the President of the CERB, his interaction with the military members was limited. Although the military members did not contribute much to the technical discussions during the CERB meetings, they were obviously learning. Dr. Raichlen found that his primary involvement with the CERB was during the meetings with each meeting being self-contained around a specific theme. There were often presentations of research and individual programs going on at CERC. He particularly remembers discussions relative to Long Beach Harbor where some researchers at CERC were erroneously planning to model resonance and waves continuously in the large wave basin. One of the most memorable meetings was the meeting in Cape Cod (Oct. 1991) during the Halloween Storm.

One of the more disappointing aspects of his service on the CERB was that the board would receive a presentation, provide comments and recommendations but never find out what happened afterwards. There was not much feedback in terms of what effect the CERB may have had on the research. He would have appreciated receiving out-briefs on the impacts or response relative to their suggestions.

What did the CERB do? The influence of the CERB is hard to separate from the contributions of the CERC. Over time the CERC has contributed a significant amount to coastal engineering. CERC studies over the years have contributed to sediment studies, new armor units, and the principles of physical modeling. The CERC fills an important niche in applied coastal research.

Author's Note: Dr. Raichlen passed away 13 December 2014

"I think most of my positive input was more on the one to one relationships, specifically discussions with the local district people and at coffee breaks with the folks doing the research."

"My benefit was in that I gained experience with the whole United States coastline and its range of erosion problems."

Dr. Paul Komar

(CERB Civilian Board Member, October 1992–September 1996)

Dr. Komar was interviewed in Corvallis, OR, in person and by telephone. He grew up in Grand Rapids, MI, and did not see the ocean until he was 12 or 13 when his father was called up for the Naval Reserve and assigned to the Virginia coast. However, his childhood hobbies included rock and fossil collecting, establishing the foundation for his future career in geology. From his frequent childhood visits to Lake Michigan beaches, he remembers being impressed by the erosion along its shores and having to climb over tree trunks that had recently fallen onto the narrow beach. He also enjoyed observing waves and the way they sorted and concentrated the sand minerals, leaving colored patterns of pink, green, black, and tan mineral concentrations.

Dr. Komar's undergraduate work was in mathematics at the University of Michigan. He received a Bachelor of Science in 1961 followed by an Master of Science in 1962. However, in his senior year he took an elective course in geology, and this rekindled his childhood fascination with waves sorting the mineral grains on beaches. The topic of his master's thesis was to understand the processes that are responsible for mineral sorting. This is a research interest he continued with through his later career. This change from mathematics to studying beaches led to his attending the Scripps Institution of Oceanography (1965–1969) in California. Growing up in Michigan, a career in oceanography was not anticipated. Arriving at Scripps was only the third time Dr. Komar had been to an ocean beach. For his doctorate he worked with Prof. Douglas Inman; his thesis included measurements of longshore sand transport rates on beaches using fluorescent sand tracers, correlating the rates with the waves and longshore currents.

Dr. Komar received a grant from NATO to spend a post-doc year in the United Kingdom (UK) studying magma flow dikes on the Isle of Skye in Scotland. He analyzed the physics of magma flow and the resulting sorting patterns of the olivine mineral grains within the otherwise fluid magma. He found similarities in the sorting characteristics to sand mineral sorting on beaches. While in the UK on his post-doc, he also spent 6 months at the Wallingford Hydraulics Research Station in England, providing him with the opportunity to work with coastal engineers who were conducting wave tank experiments to investigate longshore currents and the generation of rip currents.

In 1970 Dr. Komar became a faculty member in Oceanography at Oregon State University, where he developed a coastal research program, mainly with funding from Sea Grant. Much of his research over the years (with his graduate students and post-docs) involved investigating the causative processes and impact responses of erosion that threatened homes. This further led to analyzing climate controls, including the important roles of major El Niños, and studying decadal increases in storm intensities and their generated waves associated with global warming. His research also included analyzing the sediment transport processes around inlets on the Oregon coast, considering the evolution of those shores in response to jetty construction. This involved working with the Portland District of the Corps, applying numerical models of sediment transport and shoreline changes.

He retired in 1998 but retains an Emeritus position at Oregon State University where he continues to be active in research. His ongoing investigations focus on the effects of climate change on the coasts of the United States Pacific Northwest (Oregon and Washington) and in New Zealand.

Dr. Komar had not been familiar with the workings of CERB prior to being asked to become a member, but once he understood more about the board and its historic membership he recognized that it was an important appointment and he would have a role in help guiding the coastal research of the Corps. His first meeting was in October 1992 in Honolulu, concerned with Pacific Ocean issues. That is when he began to understand the structure and challenge of working on CERB, but he also realized that he was a beneficiary of the meetings. His first post-meeting helicopter field tour occurred in Hawaii, memorable for the rear seat, banking view of the Maui shore: "The aerial view perspective of the coast is always extremely valuable." A number of photos derived from CERB field trips have appeared in Dr. Komar's textbooks.

He was particularly interested in the research and problems faced by the Corps and its Districts: "Considering the range of coastal problems and talking with local district folks was of great benefit." Several meetings were held in Vicksburg to review their research programs. These were important as they gave the board members a great opportunity to personally interact with the investigators: "These were the meetings where I felt I made the most contributions." During his service on CERB, the Coastal Inlet Research Program was just starting up, so he became involved in reviewing the work plans. He was very impressed by the knowledge of the researchers and what they were doing. All in all it was good experience, and he got to know more about the Corps, its people, and the work they are doing.

Based on his 4-year experience serving on CERB, Dr. Komar was impressed with the General Officers, their disciple and ability to organize: "Even though we had very different backgrounds, we worked well together and maintained a friendly relationship. The Generals seemed to be very concerned about the organizational structure and education of the people already employed within the Corps." However, Dr. Komar wonders whether CERB is really the best format for judging research, as its meetings tended to be very formal and controlled. He felt that through his membership on CERB he was able to provide input to the ongoing research through his personal contacts with the investigators.

What did the CERB do? Dr. Komar has found that over the years his coastal research interests have been directed more and more toward applied problem solving, leading to increased interactions with engineers. One of the most important aspects of CERB and the Corps has been the development and use of the facility at Duck, NC. The Field Research Facility (FRF) has brought together many researchers from different backgrounds, working on both common and diverse problems. His concern is that the value of the FRF may diminish over time. He would like to see the Duck model become more mobile so that similar research could be conducted on West Coast beaches.

"The interest level of the generals on the CERB was one of the most interesting aspects. They were engaged and worked to make changes and have an effect."

"Being on the CERB gave me a chance to meet some interesting and knowledgeable people and see some great projects. After the CERB I became more of a defender of the Corps."

Dr. Billy L. Edge

(CERB Civilian Board Member, May 1998–May 2000 & February 2002–March 2006)

Dr. Edge, Professor of Civil Engineering at North Carolina State University (NCSU) was interviewed on 17 July 2013 in Manteo, NC, on the campus of the University of North Carolina's Coastal Studies Institute. He grew up in the "Tidewater area" of Virginia (Newport News) where he spent many youthful hours digging up clams and hanging around the water. He attended Virginia Tech (VT) receiving a Bachelor of Science in Civil Engineering (1964). He was also a member of the VT Corps of Cadets which lead to a commission in the Army. However, he continued at Virginia Tech receiving a master's in 1966 and then went to Georgia Tech for a doctorate (1968). While at VT he attended a seminar by Dr. Jim Hargett, the director of Virginia Institute of Marine Science, regarding oysters in the James River, Chesapeake. He learned that the oysters were saltier on one side of the river then on the other due to Corollis effect. This piqued his interest in coastal dynamics. His doctoral research involved studying wave loadings on offshore structures and determining conditions that could lead to failure. Having completed his doctoral work, he was called into military service and expected to go to Vicksburg (Waterways Experiment Station); however, at the last minute he was assigned to Detroit, MI, to work with the Lake Survey District, which was then operated by the Corps of Engineers. This experience "...really opened my eyes to coastal engineering." He worked on navigation, erosion, and wave dynamic problems. He then had to handle the Reduction In Force (RIF) as the Lake Survey District was closed and the mission transferred to NOAA.

In September 1970, he went to Clemson University as a Professor of Civil Engineering and stayed for 13 years. He had a 1-year sabbatical at Dames and Moore working on a coastal master plan for the State of New Jersey. It was during this project that he worked with Mr. Joe Caldwell (Director, CERC) and then also went with Mr. Caldwell as part of a post-disaster team to evaluate the Sines, Portugal breakwater failure (1978). After his sabbatical, he decided to enter private practice, left Clemson, and opened a company in Charleston called Cubit Engineering, Ltd. After 10 years he felt the company had to either grow or it was time to "move on." He met John Herbich at an International Conference on Coastal Engineering who invited him to consider coming to Texas A&M. After giving a seminar and receiving a

job offer, he spent 17 years teaching coastal engineering at Texas A&M. After "retiring" from Texas A&M in 2009, he and his family moved back east, accepting a part-time faculty position at NCSU to teach and provide engineering capabilities to the Coastal Studies Institute.

Dr. Edge considers himself a coastal engineering "generalist" with an emphasis on applications. His emphasis has been more on structures then on sediments, but he has also conducted work on the analysis and modeling of storm surges and waves. Currently he is working with Dr. Robert A. "Tony" Dalrymple and an extended international group of experts in developing an open source code using smoothed particle hydrodynamics on graphical processor units.

He had heard about the CERB from Professor Bob Weigel and Dr. Bob Dean. He also knew Morrough P. O'Brien and Bernie LaMehaute who had told him about the CERC and of their experiences. He greatly respected then all. The CERB seemed to be the place where decisions were made that affected the course of coastal engineering and coastal research. "I was awe struck when I got a call asking if I would be interested in being nominated to be on the CERB." His first CERB meeting was at Fort Lauderdale (June 1998). He effectively served on the CERB from May 1998 to March 2006, but there were 2 years of guest involvement (May 2000–Feb. 2002) as his and the other nominated civilian members appointments were stalled in Washington.

Dr. Edge has many memories of interesting experiences while on the CERB. Meetings included seeing the sand bypassing system at Virginia Beach, introducing the other CERB members to the muddy coast of northern Texas at the Galveston meeting, and a very informative meeting regarding the Louisiana coastal ecosystem. It was technically interesting to see the northwest coast and the deterioration of the jetty ends at a number of major navigation projects but frustrating to discover that there was no interest or funding to repair. He saw many other interesting sites including the big waves on the north shore of Oahu, HI. He learned that the Corps and the CERB really did have an effect. A significant example is with Regional Sediment Management (RSM). It was important to meet and hear from people in the local districts that were involved in trying to incorporate RSM principles.

Many good relationships were developed through the CERB. He continues to work with some of the other Civilian CERB members. Dr. Edge had fond memories of MG Don Riley who did much for the CERB during his tenure. He has encouraged MG Riley and LTG Strock and other CERB general officers to become involved in ASCE-COPRI. "I have a lot of respect for these people (military officers) and for what they do and have done." The Corps has had a major role in helping to rebuild the shore and the coastal infrastructure. Through the CERB, Dr. Edge could see the differences in the navigation jetties on the east coast relative to the west coast. He also realized the need for large nourishment projects if we are to be successful in maintaining the shore. But those kinds of projects need significant study and engineering design. The two areas of research that Dr. Edge strongly supported while on the CERB and continues to support are the need for continued work is RSM and the need to continue data collection and monitoring the performance of projects. "We need the data from observations on existing projects to improve designs for future projects."

What did the CERB do? The CERB has had an impact to the Corps and the Nation. They had a program at Texas A&M to train coastal engineers for the Corps, primarily because of the support from the CERB. Education is very important to the Corps as old talent is turning gray and we need to continue programs of education.

"I think we made a difference…we rolled up our sleeves and made things happen. Service on the board was time well spent."

"I got to spend 8 years traveling around my country and learning about its maritime infrastructure. It was an amazing experience that gave me a great perspective."

Dr. Joan Oltman-Shay

(CERB Civilian Board Member, October 2001–October 2007)

Dr. Oltman-Shay, President and Senior Research Scientist with NorthWest Research Associates, was interviewed by phone on 3 October 2013 from her offices in Redmond, WA. Dr. Oltman-Shay has been active in ocean activities since childhood. She was very interested in math and science, the outdoors, and the ocean. Her undergraduate degree (1978) was in Applied Physics from the University of California at San Diego. She then went to Scripps Institution of Oceanography to complete a master's and a doctorate in applied ocean sciences (1980) and oceanography (1985), respectively. Her research began in underwater acoustics but then she took a course in nonlinear waves from Dr. Guza and immediately changed her research to near shore waves and currents with field work at the beach instead of out at sea: "the restaurants and beds were better for near shore field work!" In 1986 she was funded by CERC to design the 8 meter depth, linear array for the Field Research Facility (FRF), Duck, NC, and to provide the analysis software. During the same period of time, she worked with Bill Birkemeier and Peter Howd to design and implement surf zone instrumentation arrays for analyzing infra-gravity edge waves and long shore currents during the 1986 "SUPERDUCK" experiment hosted by the FRF. These surf zone data led to the first observations of the then unknown shear instabilities of long shore current. Subsequently, she was sponsored by the Office of Naval Research (ONR) to participate in the multiple investigator, multi-discipline 1990 field experiment ("SAMSON" and "DELILAH") at the FRF. This work additionally provided her the opportunity to add the cross shore measurement component to the FRF's 8m array.

She first worked for Oregon State University as an Assistant Professor (1986–1990) but then moved to Seattle, WA, area because of her husband's work. In Washington State she was hired by Flow Research as a research scientist and moved out of academia. However, she did continue teaching as an Affiliate Professor for the University of Washington (1991–1993). In 1993 Dr. Oltman-Shay joined NorthWest Research Associates as a research scientist and continues with them to the present as Senior Scientist and President.

Dr. Oltman-Shay initially heard about the CERB from Dr. Richard Sternberg (Civilian Board member March 1997–May 2001), who was and still is a Professor at the University of Washington. She replaced Dr. Sternberg on the board in late 2001. The CERB is not very

broadly known outside the Corps and Dr. Oltman-Shay knew little about the CERB before discussions with Dr. Sternberg who advised her when she was appointed to the Board to: "…be aware that if you make a suggestion to a general, they may actually act on it. They are men of action…." She attended her first meeting at Galveston as an observer because her appointment had not yet gone through. After officially joining the CERB, she quickly took the opportunity to recommend a meeting on the topic of Field Data Collection to be hosted at the FRF (September 2002). She thought this venue would provide an excellent opportunity for the generals to personally witness the importance of the FRF as an internationally recognized hub for nearshore research. As a researcher who had participated in several multi-PI, multi-discipline experiments at the FRF, she could speak to the critical role of the FRF in providing a data-rich environment for conducting a broad array of nearshore experiments.

She found the CERB meetings to be very educational and well run. It was valuable to obtain a regional perspective on the maritime infrastructure of our Nation. The presentations were generally excellent and focused around the meeting theme and location. The CERB executive sessions also had very good discussions. She found it interesting to see each CERB President with his own unique management style but each also equally effective. "I walk away from this experience with great respect for the general officers. They were all good listeners and were ready to make decisions. As a citizen of our country, I was proud of them." One concern she had was the need to develop a standard approach to the CERB meetings that incorporates closure and feedback to the people from the host Divisions and Districts. This was beginning to happen towards the end of her appointment.

Dr. Oltman-Shay reflected on four major points that came out consistently over the meetings:

1. The poor state of our Nation's maritime infrastructure. After the Portland, OR (2003), and Traverse City, MI (2004) meetings, she began to understand how much the USA maritime infrastructure was struggling. "There are not enough funds made available to the Corps to maintain our nation's maritime infrastructure, and many elements have seriously degraded....There is complacency in our nation, a false idea that once the infrastructure is built, once the turning basin and channel are in place, nothing else needs to be done. Maintenance projects do not get votes."

2. The need for a regional approach to sediment management. The CERB grabbed and ran with the idea of Regional Sediment Management (RSM) they inherited from the previous CERB. "Our role was to help the generals to understand the value of taking a regional or systems approach." The challenge however was to find some way that the Corps could implement and run with RSM. Critically important leadership for this change came out of the Mobile District demonstration project. "When I left the board, RSM was an initiative that still needed to become an accepted practice."

3. The need to approach projects and decision making from a risk-based benefit analysis. Meetings that occurred post-Katrina, including the fact-finding meeting in the Netherlands (June 2007), drove home this point. The Corps has its hands tied by the way it is funded, but nonetheless, where and when possible, project decision making from a risk-benefit based approach is needed to leverage the few dollars available to meet our Nation's infrastructure needs. The advice provided by the civilian CERB members to the generals reinforced what many of the Corps District engineers were already recognizing about the importance of risk management. "We provided a valuable service and communication link in helping the generals to better understand and accept the advice of their own engineers."

4. The need for the Corps to recognize itself as an ocean agency and participate with the Nation's other ocean agencies. Dr. Oltman-Shay's experience on other ocean boards and committees: the National Academy of Science Ocean Studies Board, the Integrated Ocean Observing System (IOOS) workshops, and through professional ocean-related organizations helped the generals and Corps leadership to understand that the Corps is "an ocean organization." "The Corps is both a key user and a key provider of ocean knowledge." The CERB meetings provided a way to hear from other state and federal agencies with an ocean-related mission. The CERB helped to provide to the generals a view of how the Corps "…fits in with the other agencies.…"

Three specific meetings stand out to Dr. Oltman-Shay as pivotal in that they addressed controversial subjects from various technical views, thus prompting an in-depth exploration by the CERB:

1. The June 2003 meeting in Lafayette, LA, had the theme "Louisiana Coastal Area Ecosystem Restoration." Millions of dollars were to be spent on restoration science and engineering studies. The CERB heard presentations from various universities and local groups about their plans for using the money. "Individually they were good science projects, but there was missing an overall structure to the research. Without an overarching objective, the science projects were just 'me, myself, and I' research projects." At the time MG Donald Riley (CERB President July 2004–November 2008) was the Division Commander and heard this candid discussion about the need to establish an overarching objective to guide the research selection and prioritization.

2. The June 2005 meeting in Anchorage, AK, did not have a stated theme but included discussion from various agencies regarding the multi-dimensional problem of coastal erosion on Native American lands. Through the work of various agencies the normally location adaptable tribal villages evolved to become fixed with permanent infrastructure that would require outside assistance to maintain. However, there was insufficient foresight as to the threat of coastal erosion. This has been further aggravated by climate change, which has reduced the ocean ice-cover and increased the winter storm wave damage to the shore. This is a problem that seemed to have evolved because of a gap between knowledge and policy. "However, no one agency seems to own the whole problem and the governance is fractured. This is a bad situation that science is not necessarily going to solve."

3. The October 2006 meeting in Long Island, NY, addressed "Challenges in Coastal Protection and Restoration." This meeting put a spotlight on the Corps problem in managing important data, primarily because of its project oriented funding stream. "Corps engineers are collecting amazing data, but there is no funding to analyze the data." The Corps funding stream through individual congressionally authorized projects prohibits the proper archiving, management, and utilization of valuable data. This handicaps the District professionals in incorporating regional and risk based approaches. "The Corps should try to find a mechanism that allows for continued data analysis and archiving beyond the short project life. To do otherwise leaves us with incomplete studies. This is something that was driven home to me over my 8 years of service on the CERB."

What did the CERB do? "I was impressed with how valuable the CERB is…it brings together a remarkable group of people that have the interest of the nation at heart." The CERB did a lot to address the issues of RSM, risk management, and due diligence in the post-Hurricane Katrina activities. The CERB could do more, particularly in being an external spokesman. Further communication is needed with Congress to change the way congress handles the Corps budget. "Could the CERB get the ear of our Congress and effect policy?"

Prior to involvement in the CERB, Dr. Oltman-Shay had developed some strong relationships with individual scientists at the FRF; however, she had less involvement with CERC and even less with the Corps. Involvement in the CERB expanded her understanding of and interaction within the Corps. "Looking back, I had an amazing experience and feel that we made a contribution."

Columbia River Inlet, Oregon

"Can't deal with just the beach. Have to look at inlets and up into the basin. We developed a much broader perspective."

"I know it impressed the General Officers when we visited the Hague and they saw that all these European countries have plans for their coasts."

Dr. Robert Bruce Taylor III

(CERB Civilian Board Member, August 2001–March 2009)

Dr. Taylor was interviewed on 3 June 2013 in Baltimore, MD. He was born in 1942 in Baltimore and grew up there through high school where he attended the historic Baltimore Polytechnic Institute (Poly). At Poly he was in the advanced college placement program, but his dream was to go to the U.S. Naval Academy. As an entry strategy, he enlisted in the Naval Reserve in 1959, and from there was able to have an interview with his Congressman, take an exam, and receive an appointment to Annapolis, starting June 1960. At the academy the course work was less civil/ocean engineering and more electrical and mechanical engineering. He became interested in the nuclear submarine service. After an interview with ADM Rickover, that destiny was sealed. He graduated in 1964 and eventually went through nuclear engineering school, nuclear prototype training, and submarine school. He served in the Polaris submarine USS Daniel Webster SSN 626 and the fast attack USS Haddo SSN 604.

In 1969 he left the Navy and went to the University of Miami on a National Science Foundation fellowship to study ocean engineering. The program was an eclectic mix of courses that included coastal engineering. Dr. Taylor was hooked. Dr. Robert Dean was at the University of Florida and became his doctoral advisor. His thesis work was on tidal inlets and the theoretical studies of the physics of dispersion in multi-dimensional riverine and tidal channels. Upon completion of his doctoral studies he decided to go into consulting and formed his own company. He started working with a small firm called "Florida Coastal Engineers." His first big project involved the "re-plumbing" of the Kissimmee River. He was also engaged in the modeling of hurricane storm surges using a Tetra Tech model for the Federal Flood Insurance Program. In late 1976 that partnership dissolved and he opened a Jacksonville, FL, office for Tetra Tech (1977–1983). In August 1983 he started Taylor Engineering as a one man office. They were awarded a FEMA Delivery Order contract, and the business expanded to 13 people. Additional contracts with the Florida Inland Navigation District, FEMA, various local government agencies, and the Jacksonville District of the United States Army Corps of Engineers followed as they provided technical and engineering services in support of beach restoration, inlet management, navigation, dredged material management, and environmental restoration.

Taylor Engineering is now a well-respected national and international firm specializing in many aspects of coastal and watershed engineering studies.

Dr. Taylor's career was focused on the conduct of practical coastal engineering studies, and although he had worked a lot with Corps District offices on various projects, he had had little involvement with CERC or the Corps Research and Development program. In June 2000 he attended his first CERB meeting at Dana Point, CA. His appointment to the board did not become official until August 2001. He was eventually reappointed to a third term and completed his service in March 2009 at a meeting in Portland, OR. Dr. Taylor saw serving on the CERB as an extension of his service to his country. "It was also an opportunity to meet some great people and do some interesting things." He was the first "practicing" engineer appointed to the board and during the early 2000s the board was transformed from one that had been heavily focused on academic areas of research to one that looked at the bigger picture including regional and application concerns. This was the Board that really embraced the issues and the value of Regional Sediment Management and helped to define that perspective for USACE practices. Although the formal meetings were very structured, with an agenda designed to provide information to the board, the real work of the board began in follow-up executive sessions where we would roll-up our sleeves and get to the important work of tackling the issues.

Some of the more interesting meetings included the Portland meeting where they looked at the mouth of the Columbia River and realized the problems in addressing the maintenance needs for the Nation's coastal infrastructure. The funds required to provide for the needed repairs were prohibitive, and the scope of the problem was huge. "We got to see a tremendous variety of coastal areas and characteristics including the damaged Gulf coast after Katrina..." (from Mobile to New Orleans). "One of the high points was the fact-finding mission to the Hague where we talked about and became informed on the coast lines and policies of the Netherlands and the European Union. To my knowledge we are the only advanced nation in the world that does not have a cabinet level voice on the nation's infrastructure. In Holland they developed a national plan on their water system with guidelines and direction, which is then broken down and developed on a regional and then local basis. In the UK they conducted a study called 'Foresight' to understand the national flood risk."

The CERB was very engaged in discussions on risk, infrastructure, and national flood management. On the Board we worked with some very fine people. The quality of the General Officers was of a very high caliber. MG Riley was exceptional, but there were many other outstanding Generals we had a chance to work with. The other civilian members were also great to work with and we had good chemistry as a group.

What did the CERB do? The experience on the CERB helped to forge some really good and lasting professional relationships. We worked with the Environmental Advisory Board and had a joint meeting in Vicksburg. That lead to some really good conversations on how we should broaden our vision for the CERB. We developed an important national suite of issues for the CERB to address related to risk, environmental sustainability, and Regional Sediment Management.

"I looked forward to the next meeting, because you would hear about all the local issues…different issues in different places. I learned a lot."

"CERB is a forum for dialogue on research needs for the Corps and others. Presentations from Corps, states, and others bring up national issues that need to be addressed by research."

"Do not do away with the CERB for fiscal or budget reasons. It is too important."

Major General Patrick J. Kelly, Ret.

(Military member (SPD), June 1986–June 1988)
(President of the CERB, November 1985–June 1986 & June 1988–June 1991)

MG Kelly was interviewed on 3 September 2013 in Long Branch, NJ. He grew up in Connecticut not far from New York City, where his father was a gardener and caretaker for a large estate. Later on they moved into their own house in New Canaan, CT, and he went to prep school in Stamford, CT. In 1954 he went to Marquette University in Wisconsin to study civil engineering. They had a 5-year program including 1 year of co-op experience. His co-op assignment was with the State Highway Commission (1956–1959) working on survey crews, reviewing highway and bridge designs, and overseeing construction projects. He had also joined the Army ROTC. When he was a senior, the State Highway Commission offered him a job, but he still had a military obligation and had to go to ROTC summer camp at Fort Leonardwood, MO. He thrived at summer camp and decided to pursue a regular Army appointment rather than enter the reserves. He was offered a regular commission, and in 1959 went to engineer officer basic training at Fort Belvoir. After additional training, including Airborne School and Ranger School at Fort Benning, GA, he was assigned to Europe (1960) as a 2nd Lieutenant Platoon leader in a combat engineer battalion. He progressed within the battalion to assistant operations officer, nuclear special weapons officer, and company command. In 1963 he applied to go to graduate school to study soil mechanics. Instead he was ordered to attend the Defense Nuclear Agency Naval Post-Graduate School (USNPGS) to study nuclear physics. This was not the career path he wanted to pursue, but in the fall of 1963 he reported to the USNPGS in Monterey, CA, for 2 years, which earned him a master's. He stayed on for a third year and started work on a doctorate.

This was 1965/66 and "…since all hell was breaking loose in Vietnam. I decided to go back to my Army job." He studied Vietnamese and went to Vietnam for a year where he was an advisor. Upon returning in January 1967, he was assigned to West Point as an instructor in the Department of Physics. He went back to Vietnam in 1970, returning in 1971 to attend Command and General Staff school. In 1972 he requested assignment to USACE but instead was told to report to Livermore, CA, to attend a Defense Nuclear Agency training program in nuclear effects. He was at Livermore National Laboratory before they became a Department

of Energy (DOE) Lab. He got involved in a new group that was studying high energy laser physics and again had the opportunity to work on a doctorate. His dissertation work involved using two solid state lasers of different frequencies to create a third frequency that could be used for isotope separation. He received a doctorate in laser physics from the University of California at Davis in June 1975. Subsequent military assignments included command of the 15th Engineer Battalion at Fort Lewis, WA, the Army War College, and classified work at Redstone arsenal in Huntsville, AL.

In the summer of 1980 he finally got a chance to return to the Corps of Engineers. He was asked to command the construction of an air base in Israel. This was a high-profile assignment in response to a commitment by President Jimmy Carter during the Camp David peace accord to build two new Israelis Air Force bases. He was assigned to build the one at OVDA, located in the southern part of the Negev with the project scheduled to be completed by April 1982. He finished the air base ahead of time and on budget which gave him a pick for his next assignment. Even though he had no civil works experience, he asked the Chief (LTG Joe Bratton) if he could be assigned as the commander of the Mobile District. He was at the Mobile District June 1982–June 1985. He worked for BG Forrest T. (Ted) Gay, who was the SAD commander and military member of the CERB (July 1984–September 1985). In May 1985 Kelly became a Brigadier General and was assigned to be the Deputy Director of Civil Works working for MG Henry (Hank) Hatch who was the Civil Works Director. MG Hatch delegated responsibility for the CERB to BG Kelly as his Deputy (1985–1986). Then in 1986, Kelly was appointed as Commander of SPD and became a military member of the CERB through 1988. In 1988 LTG Hatch was selected as Chief of Engineers and MG Kelly became Director of Civil Works and again was President of the Board. Thus MG Kelly had 5 years of continuing experience with the CERB. 1991–1992 he was assigned to command the Defense Reconstruction Assistance Office (DRAO) in Kuwait following the first Gulf war. He completed his military career as the last military commander of the Army Laboratory Command. He was replaced by the first civilian Director, who was Dr. Robert Whalin, formally Director of the Waterways Experiment Station. MG Kelly retired from the Army in October 1992. After his Army career he worked for two engineering firms (Rust Engineering, part of the Waste Management Company (1992–1999) and Weston Solutions (1999–2008). He retired from the private sector in 2008 and now does some occasional consulting work, especially in the maritime industry.

"First time I heard about the CERB was when I went to DC and MG Hank Hatch appointed me to chair the CERB. Had great support from Headquarters staff — especially John Housley and John Lockhart. His first meeting was at Sausalito, CA (1986) and a major subject of discussion was the dolos being used for jetty and breakwater rehabilitation. Then they went to Fairbanks and Homer, AK (May 1986) where they learned about the coastal issues in rural Alaska. In Corpus Christi, TX (May 1987) they discussed maintaining beaches and the need for sand replenishment. There were presentations on groins and questions regarding if they really work. There was a lot of debating about structures, beaches, and sand bypassing systems. Then in November 1987 they had the first "theme" CERB meeting in Savannah, GA. The theme was Sea Level Rise, and it started the reorganization of the meeting agendas and goals to focus on and address bigger themes relevant not only to the meeting location, but also having Corps-wide significance. "We tackled a lot of hard issues. Would have local guys with complaints and local academics would come in and state their opinions. In the mid to late 1980s, we laid the ground for a lot of the work going on today, especially related to beach erosion." MG Kelly sees the CERB as more important now because of Hurricane Katrina and Super Storm Sandy and the increase of issues in coastal areas. "The CERB ought to play an important role in setting the strategy for what

we should be doing as a nation in the future use of coastal protection. The CERB ought to develop a synopsis on what our research should be doing, whether in the Corps or not." The CERB is in a unique position to provide national leadership." Some of the issues of today, particularly of concern along the Sandy devastated New Jersey coast is selecting design criteria for the height of dunes for protection vs. aesthetics. There is a lot more debate and technical background needed for dealing with these issues for people who are located in flood prone areas.

MG Kelly likes the new organization of civilian members to include non-academic individuals representing coastal engineering practice. He found that the civilian and the military members brought complementary views to the Board. The military had local knowledge of specific projects and the command challenges, while the civilian academic members brought more general, technical knowledge. He was not that involved in putting together the meetings. That was done by Dr. James Houston, Charles Calhoun, and John Housley. Having the meetings focused around themes was a good improvement. It allowed them to zero in on an issue and talk about it from different vantages. They could really drill down and understand the problem. MG Kelly thought it would be a good idea to rotate all Division Commanders with a coastal mission onto the Board. "All commanders should have an opportunity to experience the CERB. We need to take advantage of all that intellectual capability and propagate it throughout the Corps." The results of the CERB meeting should not be just an upward reporting to the Chief, but the goal should also be to get the results from the CERB meetings out to the Districts where it can affect Corps practice.

What did the CERB do? One of the initiatives of the CERB was education of Corps scientists and engineers. This was reinforced by a charge from LTG Heiberg that led to several task forces. "The CERB is very important and should not be dissolved for any reason. The issues the CERB is addressing now in Delaware, New Jersey, and New York are the same issues they have in SAD and SWD and across the nation. This meeting in New Jersey is important." MG Kelly sees the CERB meeting in NJ as facing the major coastal issues of today. They are how do we balance economic development with protection of people with sustaining the environment. "All three entwine."

New Jersey pier devastated by Hurricane Sandy

"The coastal problems between SPD and SAD were quite different and the CERB helped to give me an appreciation for how those affected the Corps' mission."

"I took advantage of the CERB to run local Division problems up the flag pole."

"I would like to think we were in a position to influence the nation's decision-making regarding coastal responsibilities."

Brigadier General J. Richard Capka, Ret.

(Military Member, November 1996–October 2000)

BG Capka was interviewed on 22 July 2013 in Washington, DC, at the offices of Dawson & Associates where he is currently Chief Operations Officer. BG Capka was a member of the CERB as both the Commander of the South Pacific Division (SPD) (Nov. 1996–July 1998) and as Commander of the South Atlantic Division (NAD) (July 1998–Oct. 2000). His father was a West Point graduate and career military, and BG Capka followed the same path. After graduating from West Point in 1971 as an engineer officer, his first assignment was at Fort Belvoir as an Aide-de-Camp to the Commanding General. From there he went to Germany and was assigned to a construction Battalion. He went to the University of California at Berkeley where in 1977 he earned a Master of Engineering degree to better prepare him for future Corps of Engineer assignments. There he meet Professor Robert Wiegel (CERB Civilian member 1974–1985) and Dr. Joe Johnson who stimulated his interest in coastal/ocean engineering. It was during a time of expanding off-shore oil production, with Condeep concrete production platforms being constructed in the North Sea and steel jacket production platforms being installed off the Monterey coast of California. His master's thesis presented an innovative approach to mitigate instability problems for these production platforms as they were towed and lowered into production locations.

Upon completing his Master of Engineering degree, he was prospectively slated for a position at CERC but the position was upgraded to a Lieutenant Colonel. As a Captain he was ineligible for that assignment. Instead he was assigned to a position in the Pacific Ocean Division (POD) as a project engineer where General Henry (Hank) Hatch (CERB President August 1986–June 1988) was his Division Commander. At POD (1980–1983) he managed a portfolio of military engineering and construction projects and eventually was assigned as the Deputy Resident Engineer for the Tripler Army Medical Center expansion project. While at POD he was also assigned to a Civil Works Planning position where he conducted an evaluation of the port and harbor conditions throughout the Marianna Islands. Following attendance at the U.S. Army Command and General Staff College at Fort Leavenworth, and a subsequent assignment to the U.S. Army Engineer School at Fort Belvoir he was selected to be the Executive Officer to the Chief of Engineers, LTG E. R. Heiberg III (CERB President 1979–May 1983). Although

only a 1-year assignment, this afforded him an opportunity to see the Corps from a much broader perspective and included travel to USACE Districts and projects. He was promoted to LTC and commanded the 1st Engineer Battalion of the 1st Infantry Division (Mech) at Fort Riley for 2 years. He then attended and graduated from the National War College at Fort McNair followed by an assignment at HQUSACE supporting LTG Hatch (then Commanding General) working on USACE /Army international programs (1991–1992).

In 1992 as the Baltimore District Commander one of his first duties was to meet with the Governor of Maryland to discuss the beach fill, seawall, and "dredge pipes" on the beach at Ocean City, MD. Although the beach renourishment project would accrue great benefit to beach front business interests the discharge pipes were an unwelcome nuisance, an eyesore and barrier for hotel guests having access to the water. An innovative solution was reached to allow public use of completed sections of pipe as a beachfront "canvas. "Budding artists competed their artwork in a competition judged during the peak summer season. Additionally, crosswalks were built over the pipes to improve public access to the beach during the project. Adding this experience to that of his being introduced to the effects sea turtle nesting environmental windows imposed upon dredging operations he quickly concluded that the dredging itself was the "easy part." Planning and executing these projects so they can be successfully accomplished under both anticipated and unanticipated challenges are the hard parts. CERB and other repositories of past experiences were very helpful to limit the number of lessons that had to be "relearned".

Capka was then assigned as the senior engineer for United States Forces Korea (1994–1996) coordinating facility construction projects. He was promoted to Brigadier General and assigned as South Pacific Division (SPD) Commander in 1996. This was a time of transition for SPD and also for the Corps Division structure. For a while the Pacific Ocean Division and the South Pacific Ocean Divisions were scheduled to combine, although that never occurred. Instead, Corps efficiencies were gained through the Albuquerque District's realignment to SPD; Alaska District's realignment to POD and the Northwest District was formed through the merging of the Missouri River and Northwest Divisions. Additionally further realignments occurred and formed the Mississippi Valley Division and Lakes and River Division. Division offices in "high rent" areas were closed, and the Civil Works boundaries re-crafted to better fit with state boundaries.

As SPD Commander he saw the Corps' mission being accomplished during a period of growing emphasis on environmental programs, from the clean up of BRAC sites to the placement of dredged material resulting from dredging operations. 1997 through 1998 was also a period of major flooding in central California along the Sacramento and San Joaquin Rivers. Because of environmental awareness there were questions regarding how to manage the flooding and the rivers. There was controversy regarding which levees to fix and the effects on endangered species. It was during this period that Capka first became a member of CERB and represented coastal matters along the California coastline. Shielding harbors and channels from the wave energy and keeping channels open and accessible were significant challenges.

He was reassigned to command the South Atlantic Division in 1998 and he retained his position on the CERB. The issues in SAD were different as they focused on shore processes affecting barrier islands stabilization, beach restoration, and hurricane damage reduction. The problems were quite different. Again CERB explored these challenges, offered prioritized suggestions for research to enhance our understanding of the challenges and continued as a repository of knowledge for the Corps coastal Districts use when undertaking work in this area.

BG Capka retired from the Army in 2000 and was then selected by the Governor of Massachusetts to lead the Boston "Big Dig," which was, at the time the largest infrastructure project in the country, and another project that included inherited problems. He was then invited to join the administration, with the Federal Highway Administration (FHWA) in 2002. From 2006 to 2008 he was the Administrator of the FHWA. Since February 2008 he has been the Chief Operating Officer for Dawson & Associates.

"The first to introduce me to the CERB was Professor Robert Weigel while I was a graduate student of his at UC Berkeley. After telling me about the wonderful opportunities to contribute in a meaningful way he told me there were 'perks', as well. He told me "CERB seems to pick some outstanding places for their meetings." At Berkeley Capka had been introduced to the Shore Protection Manual and learned that it nicely "…distilled the esoteric math to formulas which could be put easily into practical use." Capka realized that while the CERB did not establish policy, it did make respected recommendations and it provided an excellent forum to discuss policy issues. Their deliberative discussions were excellent and focused to address issues such as the effects of shore processes on beaches, channels and other shoreline features. The makeup of the CERB membership provided a nice blending of the engineering, federal, state and local policy matters and academia capacity. BG Capka had Oregon Inlet and the Florida inlets and Dauphin Island, AL under his command at SAD and these discussions were very germane. He particularly recalled discussions with Dr. Bob Dean regarding matters where Federal and state policies and responsibilities intersected. While Federal priorities dominated, it was important for the Corps to be respectful of state matters. "Obviously priorities differed based upon perspective and the definition of the public interest being served." Also an important challenge was the fact that political boundaries often interfered with the ability to execute comprehensive and consistent policies. Capka found that on the CERB he was dealing with many of the same issues he had to handle as a Division commander.

He particularly remembered one of the last meetings on the applications of coastal engineering to military needs (Honolulu, HI, April 1999). They discussed how coastal engineering could contribute to improving LOTS (Logistics Over the Shore). They also discussed how to support the military overseas operations. The USACE LIDAR program (developed by ERDC, operated by Mobile District) also supported military activities such as LOTS and provided data for civil works shore studies. Many of the discussions and knowledge from previous meetings and both his military and civil works experiences seemed to come together. A meeting at Duck, NC, involved reviewing the research program and looking at data collection platforms. He found the CERB to be very rewarding, not only because of the topics that were discussed but also because of the relationships created with the other board members.

What did the CERB do? The CERB provided an excellent forum for discussing important issues (such as the Federal interest in assuming a role in preserving a "status quo" on barrier islands and whether problematic storm impacted inlet channels should be maintained). While these issues would ultimately be politically crafted policy decisions, having the CERB deliberate the matters was an important part of the vetting process. It was important to have

the Director (now Deputy Commander) of Civil Works as the President of the CERB to ensure the CERB had the right level of access to the Corps decision making process. The Board meetings helped the Corps to "Define the problem first, before looking for a solution. Solutions would follow more slowly." "For me personally, I found that my graduate school exposure to Coastal Engineering helped me understand more clearly the challenges that were being addressed by the CERB."

Oregon Inlet, North Carolina

"The CERB helped me to become aware of coastal engineering issues not only in my Division, but world-wide."

"CERB provided a forum through which I could become educated and allowed me to tap into knowledge resources of the board and to leverage assets in other areas."

Major General Merdith W. B. (Bo) Temple, Ret.

(Military member (NAD), February 2003–July 2005)
(President of the CERB, November 2008–August 2010)

MG Temple was interviewed on 20 August 2013 at the USACE Office of History at Fort Belvoir, VA. He was born and grew up in Richmond, VA. He remembers family vacation trips to the Eastern Shore, Virginia Beach, and the Outer Banks of North Carolina. His parents had moved to Richmond from rural southern Virginia. His father had only seven years of education, served in World War II, and then under the GI Bill finished high school, went on to the Medical College of Virginia, and became a doctor. With that background MG Temple was brought up appreciating hard work, education, science, and the value of practical work. His mother was very well-read and engendered in him an appreciation for history and the humanities. During high school he was in the cadet corps. He went on to Virginia Military Institute (VMI) for his undergraduate and military training. The small teacher-to-student ratio at VMI facilitated a focused education. He received his Bachelor of Science in Civil Engineering in 1975 and, despite the post-Vietnam drawdown, was successful in attaining a commission in the U.S. Army Corps of Engineers (16 May 1975). He enjoyed the army and its mission. Of his 37-plus years in the army, he spent the first 26 years in operational assignments as a combat engineer. His professional development opportunities included graduate school at Texas A&M where he received a Master of Science in Civil Engineering (May 1985), the Army's Command and General Staff College (1989), and the Army War College (1998). His assignments included a tour in Europe and in Turkey as well as service in theater during Desert Storm and during Operation Enduring Freedom (Iraq). In the summer of 2001 he was assigned by the Chief of Engineers to USACE's Transatlantic Center (TAC). During this time of response to 9/11, he was able to leverage his operational experience with TAC's contract construction management experience to address challenges with the build-up for the wars in Iraq and Afghanistan. After 16 months at TAC, he was assigned as Commander of the North Atlantic Division (NAD) in 2003. At NAD he oversaw both military and civil missions and "that was where I learned about coastal engineering."

As the NAD Commander he had a seat on the CERB and also on both the Delaware and the Susquehanna River Commissions. He soon realized the importance of understanding the

relationship between these river systems and the sea. "My whole Division was on the sea, and each District had a coastal mission (except Europe District)." He knew nothing about the CERB when first appointed and, as an operational person, was skeptical that the CERB could help him to better execute his mission. However, he found the mixture of Corps, private industry, and members from academia was a very important educational and consultative asset. "I took away a lot from my experience in being a member of the board." One of the important issues for MG Temple was that the board helped him to come to grips with understanding technical issues such as how ocean mechanisms effect the coastal missions. It was particularly beneficial to better understand how riverine and coastal environments interact. This led to a deeper appreciation for using a systems based approach for dealing with coastal projects. He learned about the difficulties in modeling the critical interface between coastal and river systems and about the importance of developing good baseline and monitoring data. "Need good data to drive good models…and data collection, model development, model running, calibration and verification, all take a lot of money." "An important role of the Board was to help to decide priorities and where the money should go and on what it should be focused." The mix of Corps, academia, and private sector really helped to make the decisions on how and where to apply the assets.

His exposure to the CERB helped with particular missions and projects of NAD. Membership on the CERB helped him to better understand the technical issues associated with the impacts of deepening projects including impacted species and environmental health. At NAD they looked at restoration projects to filter some of the run-off and to improve water quality. They also had a major project for the Baltimore Harbor deepening. That included the beneficial use of dredged material for the reconstruction of Poplar Island in the Chesapeake Bay for environmental enhancement. "Some of the species started to return as soon as we started the reconstruction." He discovered that these projects are not just built and done. You have to look at the total life cycle of the project. These types of projects have far-reaching impacts and need to be monitored. "There is a need to see if (the project) is having the desired effects, and if not, to adaptively manage to adjust to the new reality. These are the kind of things the CERB was interested in." Other important discussions and insights from his experience on the CERB was the importance of data ("who collects what and how is it going to be used") and models ("who is going to build them, what is it going to do, it is the right model with the right data, and how are we going to use the results."). All these elements and issues tied together in order to properly manage the coast.

After Commanding NAD, he was assigned to Corps Headquarters to lead Military Programs (2005). He then moved on to become Deputy Commander for Civil Works (2008) and rejoined the CERB as its President. In 2010 he became the Deputy Commanding General for the Corps and then Acting Commanding General until his retirement on 1 September 2012. He found that the Board evolved beyond just data and modeling to risk assessment and managing risk. Concerns regarding risk and how best to address risk were driven by the 2004 Florida Hurricane season and Hurricanes Katrina and Rita in 2005. Some issues included: do we restore or adaptively manage, and if we restore, what does that do to system-wide risk? The coastal and ocean environment is so dynamic that the solutions of the past may not apply to the future. "This means we have to model future conditions and look forward, not just looking backward alone to inform the future." "With guidance from the CERB, ERDC went way back to [model storms from] the 1700s and developed a model that was more forward-looking. ERDC then used probabilistic modeling and multiple storms to develop future scenarios for New Orleans and the Mississippi coast that helped shape the 100-year level of protection plan." The Corps had a charge from President Bush to build/restore a 10-year level of risk reduction in just

5 years (2006–2011). "The CERB had a lot of input that drove the modeling and the design-build process for the Mississippi coast and the New Orleans.... The CERB helped the Corps to choose the right place, right models, and the right solutions."

As President of the Board, MG Temple found that part of his job was providing grounding and focus for the members, many of whom had strong personalities and strong view points. The Civilians would bring in an academic perspective, while the military would look for practical solutions that could immediately fix the problem. The private sector view added a different perspective. "My role was to keep everyone focused and to try to achieve a consensus so that the CERB's important work could move forward in as productive a way as possible." All views and inputs were voiced, but everyone also worked together to develop a group recommendation. It was very important to have other agencies present and to hear their views. NOAA has an important coastal mission as do other agencies and many state governments. "One of the challenges was trying to keep the group focused on problems that we could solve within our respective authorities."

What did the CERB do? The CERB serves an important mission for the nation in helping to address complex coastal issues such as the challenges with climate variability, maintaining coastal infrastructure, and balancing with public needs. Coastal science helps us to understand how the processes affect risk and impact the environment. "If we understand the coastal hydrodynamics it will help to lead us to better solutions."

Poplar Island, Chesapeake Bay, Maryland

Delaware Bay

"The unwritten charter of the CERB is for the civilian members to teach the military."

"As Director [of Civil Works] I did not often have the chance to see the technical work happening at the districts. The CERB gave me the opportunity to see more of the engineering expertise in the field."

Major General Don T. Riley, Ret.

(President of the CERB, July 2004–November 2008)

MG Riley was interviewed on 10 July 2013 in Washington, DC, at the offices of Dawson & Associates where he is currently Senior Vice President. He grew up in Livermore, CA, near the Lawrence Radiation Laboratory at Livermore (now a Department of Energy National Laboratory) where his father worked. His father fabricated unique equipment needed to support nuclear fission research. He inherited from his father an interest in how things worked. After seeing a recruiting film from West Point he was intrigued by the opportunities and challenges (and free college tuition) and decided to take that path. He received his Bachelor of Science from the United States Military Academy at West Point in 1973 and joined the Corps of Engineers. His first assignment was as a combat engineer at Fort Ord. He then went to Fort Belvoir for the Engineer Course, took his EIT, and was sponsored by the Army to attend the University of California at Berkeley to pursue graduate studies. He studied geotechnical and construction engineering, receiving a Master of Science in Civil Engineering in 1980. As a Captain he received his first Corps of Engineers assignment (1980–1982) in Seoul, Korea, working for the Far East District where he oversaw various construction projects (facilities, roads, barracks, schools, milk plant, etc.). He had a civilian boss who told him "call me if you need me," but otherwise he got to run his project office the best he saw fit. He came back to the Engineer School at Fort Belvoir as an instructor for building roads and airfield (1982). He also became Aide-de-Camp for Engineer School Commandant (1983–1984) and led the first Small Group instruction for the Engineer Officer Advanced Course.

In 1985 Major Riley went to Leavenworth, KS, to attend the Command and General Staff College. This was followed by assignments at the School for Advanced Military Studies, in Germany (1987–1990), Fort Polk, and Fort Hood, and then the Army War College at Carlisle, PA. Eventually he commanded the 555th Engineer Group at Fort Lewis, WA. At Fort Leonard Wood, MO, he worked for LTG Bob Flowers directing the Army Engineer School's "Battle Lab" (1997–1998) and then moved to Fort Monroe, VA, to serve as the Executive Officer for the Training and Doctrine Command (TRADOC) Commanding General.

From 2000 to 2002 he was again assigned to Germany as the 7th Army Engineer/DCSENG USAREUR focusing on military construction. His team would work on the requirements and

basic design, then provide funds to the European Office of the Corps that completed the detailed design and oversaw the construction contract.

LTG Flowers visited him in Germany and told him that he was transferring him to Vicksburg to lead the Mississippi Valley Division and Mississippi River Commission as its President, Gen. Riley's first experience in Civil Works. There were several high-visibility, big-problem projects to deal with including finishing the Upper Mississippi Navigation Study and getting the Louisiana Coastal Area Restoration Study (LCA) on track. He learned a lot about navigation and economics primarily by listening to his staff and making sure everyone involved in the study provided their input. Everything with the LCA involved science and research and ERDC was a key element to make that work.

His first exposure to the CERB was when the CERB came to Lafayette, LA (2003), and reviewed the LCA program. "We talked to the CERB about the study and provided an update. Met in executive session and there was an out brief that made recommendations on the management of LCA. I thought the recommendations would be on technical engineering aspects of the project, but we also received input on how to manage the many stakeholders."

In June 2004 he was assigned as the Deputy Commanding General for Civil Works (DCW) and within 2 weeks had to deal with the first of four major hurricanes to hit Florida. The Corps responded well, but he discovered that the Corps did not have Standard Operating Procedures (SOP) for handling the many different Corps activities for that scale of an emergency. Then in August 2005, Hurricane Katrina hit, and he commanded the Corps' post-Katrina emergency support.

As DCW he was President of the CERB. His first meeting with the CERB, as President, was just after the four Florida hurricanes in Silver Spring, MD (November 2004). He was President of the Board until November 2009, a total of 4.5 years and "a wonderful experience."

There were three primary areas which summarize what MG Riley sees as the major benefits he got out of being President of the CERB:

1. He was very impressed with the talent of the civilian membership. "Military commanders are just not brought up with that caliber of insight and technical training on coastal engineering."

2. There is great expertise at ERDC. It is a "National treasure." "There is nothing else like it out there."

3. He was also very impressed with the Corps people from the Districts and Divisions and the work that they are doing. The CERB provided him with a good opportunity to see the broad talent and expertise of the Corps.

As DCW and as President of the Board he wore two hats relative to determining the priorities for investing Civil Works funds into Research and Development. He felt that there was not a good process for developing research priorities and guidance for R&D while also weighing the recommendations of the CERB. Regional Sediment Management was an impressive program that brought a lot of value in spite of being challenged by underfunding.

Another continuing problem was the constant lack of data. There are never enough data. Notable learning opportunities were the fact-finding trip to the Netherlands (June 2007) and seeing the deteriorating jetties on the Columbia during the Portland meeting (2008). There were opportunities at each meeting for ERDC people to present their work. MG Riley would require that the meeting plan have very specific goals and stated intentions that could be presented to the Chief. The meetings and presentations were focused on specific objectives and fell together nicely around a theme of interest to the Board.

He thoroughly enjoyed the relationships with the other Board members. Both the civilian and military members were dynamic and impressive individuals. Some of these professional relationships are still continuing now that he has moved into private life.

The Chief was briefed a couple of times on major CERB initiatives. However, one lesson is that the CERB and its activities should be briefed to the Chief, at least annually.

After retiring from the Army in 2008, he started to work for Dawson & Associates. In his current position he has had opportunities to interface with several of the former civilian Board members for advice and in developing professional contacts. The CERB provided him with technical insights that are important in his current position.

What did the CERB do? The CERB had a direct impact on LCA. As President of the Board he had directed the CERB to help facilitate Mobile and New Orleans Districts to work together across the Mississippi Coastal Improvement Program and the LCA in conducting the post-Katrina Hurricane Storm Damage Reduction studies. He directed both studies to fund ERDC to conduct studies and develop models of the physical processes across State and District boundaries to provide a framework for a true regional analysis. Otherwise, because of the way studies are funded, it is difficult to conduct system or regional based analysis. This emphasized the need to manage regions systems where various projects are part of the same watershed. Other examples of systems requiring integrated regional studies are the Ohio River and the Great Lakes.

CERB has promoted and can even further promote public education. The public should have a better understanding of the risk associated with living on the coast. The CERB can help to give higher visibility to this and other critical coastal issues such as climate change and help the public to better understand the facts.

Mississippi River Delta

"We discussed the collaboration and integration between science and society needed to solve the problems… the engineering role!"

"The role of the CERB should be to develop a national call to action… this is still evolving. The mission is not complete."

Major General Michael J. Walsh, Ret.

(Military member (SAD), July 2004–August 2006)
(President of the CERB, December 2011–November 2013)

MG Walsh was interviewed on 8 October 2013 at USACE Headquarters. At that time he was completing his assignment as the Deputy Commanding General for Civil and Emergency Operations and he retired from the Army in November 2013. He grew up in Brooklyn, NY. His father was a brick-layer, as was his grandfather. The whole family was in the construction business. He was the first male in the family to graduate from high school. He learned a lot of practical knowledge from his family and saw an education in civil engineering as an extension of the family business. While in college he joined the ROTC program to learn leadership skills. He graduated from Brooklyn Polytech in 1977 with a Bachelor of Science in Civil Engineering and an ROTC commission. As a Second Lieutenant, his first assignment was to a combat heavy platoon where he learned the technique of using earth moving equipment and the importance of soil compaction methods. Through subsequent assignments, he also worked with a vertical platoon and had a wide variety of building experiences including airfield aprons, concrete runways, and facilities rehab. MG Walsh spent his entire Army career assigned to an engineer position, which is quite unusual, but for 20 years he was assigned to military tactical units. His first USACE experience was as a Captain assigned to Baltimore District (1984–85) working as a project engineer building the Army INSCOM building at Fort Belvoir. His first Civil Works experience was when he was assigned as the San Francisco District Commander (1994–1996). "I didn't plan on making the Army a career. Just kept enjoying the challenge and always looked forward to the next mission. Now finishing 36 years in the Army and still not sure I would describe this wonderful time as a career choice."

After the Baltimore District assignment, he went to Command General Staff College at Fort Leonard Wood and then was assigned to a heavy combat unit (1989) and deployed for 6–7 months providing engineering support during Desert Shield/Desert Storm. While working on installations at Fort Steward, he was assigned to lead an environmental task force dealing with environmental issues associated with the red-cockaded woodpecker. As Commander of

SPN he was again dealing with environmental situations and also dealing with coastal problems. "That is when I found out that coastal engineers are different…a lot of it is not hard science, much of it is art." He later went on to command the Sacramento District (1998–2001) and planned, designed, constructed infrastructure dealing with riverine flooding. These two assignments gave him exposure to a wide variety of civil works issues and the project development process. He then went to USACE Headquarters for 3 years working first as Executive Director for MG Robert Griffin when he was Director of Civil Works, and then as Chief of Staff for the Commanding General, LTG Robert Flowers. In 2004 he was promoted to Brigadier General and assigned as the SAD Commander (2004–2006). Included in this assignment was an appointment as a Military member of the CERB. His next assignment was as Commander of the Gulf Region Division in Iraq. He was the Engineer for both Generals Casey and Petraeus. This was the transition period in both leadership and strategy in Iraq with the Army moving its forces out into the population. "It was a huge learning opportunity to see how senior leaders move from one path to another." From 2008–2011 he was assigned as the commander of MVD and in 2011 returned to Corps Headquarters as the Deputy Commanding General for Civil and Emergency Operations. In this position he became the 24th President of the CERB serving from December 2011 to November 2013 when he retired from military service.

MG Walsh had not heard about the CERB until he became the SAD Commander and was appointed to the board. In 2004 he had just come on board as the SAD Commander, when four hurricanes hit Florida causing devastation on both the east and west coasts. These events triggered Flood Control and Coastal Emergency (FCCE) investments for USACE projects that were damaged by the storms. "The LIDAR runs were very important in trying to restore Florida after the 2004 hurricane season." The LIDAR data was important in providing both the baseline and the storm impact data that was needed to drive the design for the beach restoration projects. "My first recollection of the board was in June 2005 when the board traveled to Alaska…the coastal engineers were talking about the hard choices." The Alaska CERB meeting focused on coastal erosion and how to deal with the impacts, especially to Native American villages. Climate change had reduced ice cover and allowed more storm waves to reach the shore. The effect was dramatic to these isolated villages, and difficult decisions would have to be made regarding the use of coastal structures for protection versus moving the villages. "I found that I learned a lot from the coastal engineers on the board talking about the coastal issues and trade-offs between technical concerns and social/people issues....This meeting gave me a chance to see what engineers and scientists can and should do." From this meeting the board recommended increased USACE support to the Integrated Ocean Observing System (IOOS) to promote the development of the data points needed to better understand sea ice cover trends and Arctic storms. "As the SAD commander I was a leader but had moved away from technical engineering. Talking to the coastal engineers was very educational to me and helped me to reignite my engineering technical interests. When I talk to new Division Commanders, I tell them that I learned more during that one week (Alaska CERB) on technical issues then I had learned in the last 2 years."

Two other initiatives while he was on the board as the SAD commander included Regional Sediment Management (RSM) and the education of coastal engineers. SAD had the lead for RSM as the Mobile District had conducted the first demonstration of RSM. MG Walsh worked to ignite the interests of

the other Districts in the Division in RSM and to use it as a means to better develop the concept of dredged material as a resource. Membership on the board helped him to better understand the potential value and in promoting RSM adoption throughout the Division. The other issue he particularly remembered was discussions regarding the need for investment in the training of coastal engineers. It is a professional skill set important to the Corps, but we are not investing what is needed to get graduate students interested in this area and then train them. "Our nation is not investing a lot of money into coastal science and engineering. Do we let a national treasure such as USA coastal engineering wither, or do we invest in more training?"

Hurricane Katrina, in 2005, had an impact on the subsequent board meetings. The November 2005 meeting in St. Petersburg included a lot of debate regarding Hurricane Katrina. There was dialogue about the struggle with determining what level of protection we should be using for project design. We particularly do not have a good design criteria regarding level of protection for beach protection projects. "I remember conversations with the Governor of Mississippi on what level of protection we should be designing for…do we build lines of protection or ecosystem and wetland restoration? …these are the trade-offs on levels of protection. The MsCIP (Mississippi Coastal Improvements Project) helped to address this problem and put together a good solution."

"When I became President of the CERB I asked the question: why do we have the CERB and what does it do?" The CERB came about as an outgrowth of significant momentum from local government organizations. The states and Non-Government Organizations (NGOs), particularly the ASBPA, asked the Federal government to get involved in addressing coastal protection and engineering in the early part of the 20th century. Where subsequently, the Chief of Engineers put together the Beach Erosion Board (BEB) and then came the CERC and CERB in 1963. "I don't think there is currently a lot of momentum for the Feds to take care of coastal issues from state and local governments. Where is the hue and cry from NGOs and states for the Feds to address coastal issues? Then came Sandy!"

"How do we ignite the passions of the Nation to take care of the coast? Not sure the CERB was able to do that...but Superstorm Sandy did! This is reflective of how as a nation we respond to infrastructure and engineering issues. We wait for things to fail before responding. I flew the coast many times after Superstorm Sandy and saw that the communities that were behind engineered beaches fared far better than those without engineered beaches. Congress authorized $60 billion to respond to our lack of preparedness. $5 billion of that was for the Corps. Most of the coast had projects that were authorized, but few were funded."

What did the CERB do? "The value of the CERB is still developing." Governor Chris Christie (NJ) says we are not going to abandon the barrier island,… "but I have not seen the hue and cry from other states. We as a nation are not looking at it from a national perspective." The CERB has to help us to determine what type of research is needed, to help figure out how to fund it, and how to change that science into engineering. ASBPA and the states need to push the Federal government and deliver the call for action. The NGOs are in a better position to articulate the value of the beaches and the value in investing in coastal research and engineered coastal works. The Corps has $3 billion worth of projects that are authorized, but not built. The call to make it happen has to come from the local people influencing their political representatives.

The Native American village of Shishmaref, Alaska. Photo: Alaska Shorezone

Appendix B: List of CERB Members (1963–2016)

Civilian Members of the Board on Coastal Engineering Research	
Dean Morrough P. O'Brien	Nov. 1963–June 1980
Mr. Willard N. Bascom	July 1981–July 1985
Dr. Chiang Chung Mei	July 1985–June 1989
Dr. Fredric Raichlen	Sep. 1989–Oct. 1993
Dr. Edward K. Noda	Nov. 1993–May 1998
Dr. Billy L. Edge	May 1998–May 2000
Dr. Billy L. Edge	Feb. 2002–Mar. 2006
Dr. Richard J. Seymour	Mar. 2006–Mar. 2012
Dr. David L. Kriebel	May 2012–Apr. 2016
Dr. Nicole Elko	Aug. 2016–
Dr. Thorndike Saville, Sr.	Nov. 1963–June 1969
Dr. Robert G. Dean	June 1969–June 1981
Dr. Bernard LeMehaute	Apr. 1982–July 1988
Prof. Robert O. Reid	Aug. 1988–Oct. 1992
Dr. Paul D. Komar	Oct. 1992–Sep. 1996
Dr. Richard W. Sternberg	Mar. 1997–May 2001
Dr. Joan M. Oltman-Shay	Oct. 2001–Oct. 2007
Ms. Margaret A. Davidson, J.D.	Dec. 2007–Feb. 2012
Mr. William H. Hanson	May 2012–Sep. 2016
Dr. Robert Holman	Nov. 2016–
Dr. Arthur T. Ippen	Nov. 1963–Apr. 1974
Prof. Robert L. Wiegel	Aug. 1974 –June 1985
Dr. Dag Nummedal	July 1985–June 1989
Dr. Robert A. Dalrymple	Sep. 1989–Oct. 1993
Dr. Robert G. Dean	Nov. 1993–Apr. 2000
Dr. R. Bruce Taylor	Feb. 2002–Mar. 2009
Mr. John R. Headland	Apr. 2009–Mar. 2015
Dr. Falk Feddersen	Oct. 2015–

Military Presidents of the Board on Coastal Engineering Research	
MG Jackson Graham	Nov. 1963–Aug. 1966
BG Walter P. Leber	Aug. 1966–Feb. 1967
BG Harry G. Woodbury, Jr.	Mar. 1967–Apr. 1968
BG Charles C. Noble	May 1968–Jan. 1969
BG Francis P. Koisch	Jan. 1969–Apr. 1972
MG John W. Morris	Apr. 1972–Aug. 1975
MG Ernest Graves, Jr.	Sep. 1975–July 1977
MG Charles I. McGinnis	July 1977–1979
BG Hugh G. Robinson (Acting)	1978
MG E. R. Heiberg III	1979–May 1983
BG C. E. Edgar III	May 1983–Nov. 1985
BG Patrick J. Kelly	Nov. 1985–June 1986
MG H. J. Hatch	Aug. 1986–June 1988
MG Patrick J. Kelly	June 1988–June 1991
MG Arthur E. Williams	June 1991–Aug. 1992
MG Stanley G. Genega	Aug. 1992–Oct. 1996
MG Russell L. Fuhrman	Oct. 1996–July 1999
MG Hans A. Van Winkle	July 1999–July 2001
MG Robert H. Griffin	July 2001–Sep. 2003
MG Carl A. Strock	Sep. 2003–July 2004
MG Don T. Riley	July 2004–Nov. 2008
MG Merdith W. B. (Bo) Temple	Nov. 2008–Aug. 2010
MG William T. Grisoli	Aug. 2010–Dec. 2011
MG Michael J. Walsh	Dec. 2011–Nov. 2013
MG John Peabody	Nov. 2013–Aug. 2015
MG Donald E. (Ed) Jackson	**Aug. 2015–**

Military Members of the Board on Coastal Engineering Research	
BG Peter C. Hyzer	Apr. 1964–Oct. 1965
BG George H. Walker	May 1966–May 1967
MG Thomas J. Hayes III (SAD)	Oct. 1967–July 1969
BG William W. Watkin	Oct. 1969–Apr. 1970
BG F. A. Camm (SPD)	Oct. 1970–Apr. 1972
BG G. B. Fink (SPD)	Oct. 1972–Mar. 1974
BG Richard M. Connell (SPD)	June 1975–Apr. 1978
COL William E. Vanderberg (SPD)	Apr. 1978–Aug. 1978
BG Norman G. Delbridge (SPD)	Aug. 1978–July 1980
BG Richard M. Wells (NPD)	July 1980–July 1981
BG James W. van Loben Sels (NPD)	July 1981–July 1984
BG Forrest T. Gay III (SAD)	July 1984–Sep. 1985
BG Paul F. Kavanaugh (NAD)	Sep. 1985–June 1986
BG Joseph Pratt (NCD)	Sep. 1986–Aug. 1987
BG Theodore Vander Els (NCD)	Oct. 1987–Nov. 1989
COL Daniel M. Wilson (NED)	Nov. 1989–Aug. 1990
BG Roger F. Yankoupe (SPD)	Aug. 1990–Oct. 1992
BG Paul Y. Chinen (NAD)	Oct. 1992–Sep. 1994
MG Milton Hunter (NAD)	Sep. 1994–July 1997
BG Robert L. Van Antwerp, Jr. (SAD)	Aug. 1997–July 1998
BG J. Richard Capka (SAD)	July 1998–Oct. 2000
MG Phillip R. Anderson (SAD)	Oct. 2000–Nov. 2001
BG Peter T. Madsen (SAD)	Nov. 2001–Sep. 2003
BG (P) Randal R. Castro (SAD)	Sep. 2003–July 2004
BG Michael J. Walsh (SAD)	July 2004–Aug. 2006

Military Members of the Board on Coastal Engineering Research	
BG Joseph Schroedel (SAD)	Aug. 2006–May 2009
MG Todd T. Semonite (SAD)	May 2009–May 2012
BG Donald E. Jackson, Jr. (SAD)	July 2012–July 2014
BG C. David Turner (SAD)	July 2014–
BG Arthur H. Frye, Jr.	Apr. 1964–Dec. 1964
BG Ellis H. Wilhoyt, Jr.	June 1965–Dec. 1966
BG John A. B. Dillard, SPD	May 1967–May 1968
MG Charles M. Duke	Oct. 1968–Oct. 1970
BG E. Graves, Jr. (NCD)	Apr. 1971–Oct. 1973
BG Walter Bachus (NCD)	Sep. 1974–
BG Robert Moore (NCD)	Oct. 1975–Aug. 1978
MG Richard L. Harris (NCD)	Aug. 1978–1980
BG Hugh G. Robinson (SWD)	1980–1983
BG Robert J. Dacey (SWD)	1983–Oct. 1984
MG George R. Robertson (NPD)	Oct. 1984–Sep. 1987
MG C. E. Edgar III (SAD)	Oct. 1987–Nov. 1988
MG Robert M. Bunker (SAD)	Nov. 1988–July 1990
MG John F. Sobke (SAD)	Aug. 1990–Jan. 1992
BG Stanley G. Genega (SAD)	Jan. 1992–Aug. 1992
BG Roger F. Yankoupe (SAD)	Oct. 1992–Aug. 1994
BG Ralph V. Locurcio (SAD)	Aug. 1994–Apr. 1996
BG Bruce K. Scott (SPD)	Apr. 1996–Aug. 1996
BG J. Richard Capka (SPD)	Nov. 1996–July 1998
BG Peter T. Madsen (SPD)	July 1998–July 2001

Military Members of the Board on Coastal Engineering Research	
BG Robert L. (Larry) Davis (SPD)	Aug. 2001–June 2003
BG Robert L. (Larry) Davis (POD)	June 2003–July 2005
BG Gregg F. Martin (NWD)	Aug. 2005–Nov. 2007
BG John R. McMahon (SPD)	Jan. 2008–Jan. 2009
BG William R. Rapp (NWD)	Jan. 2009–Nov. 2009
BG John R. McMahon (NWD)	Nov. 2009–June 2012
BG Michael C. Wehr (SPD)	June 2012–Apr. 2014
BG C. David Turner (SPD)	June 2013–June 2014
BG R. Mark Toy (SPD)	June 2014–Aug. 2016
BG John C. Dalrymple	Apr. 1964–June 1965
BG David S. Parker	Oct. 1965–
BG Francis P. Koisch (NAD)	Dec. 1966–Sep. 1968
MG William M. Glasgow, Jr.	Oct. 1968–Sep. 1969
MG Richard H. Free (SAD)	Oct. 1969–Mar. 1971
MG D. A. Raymond (SAD)	Apr. 1972–May 1973
BG Carroll LeTellier (SAD)	Sep. 1973–June 1976
BG Kenneth E. McIntyre (SAD)	June 1976–June 1979
MG Joseph K. Bratton (SAD)	June 1979–1980
MG Bennett L. Lewis (NAD)	1980–1981
COL C. E. Edgar III (NED)	1981–1982
BG Thomas E. Sands (NAD)	Sep. 1982–July 1984
BG Donald J. Palladino (SPD)	July 1984–June 1986
BG Patrick J. Kelly (SPD)	June 1986–June 1988
BG Robert C. Lee (SWD)	Nov. 1988–July 1990
BG Stanley G. Genega (SWD)	Aug. 1990–Jan. 1992

Military Members of the Board on Coastal Engineering Research	
BG Ralph V. Locurcio (POD)	Jan. 1992–Aug. 1994
BG Henry S. Miller, Jr. (POD)	Aug. 1994–Aug. 1995
BG Henry S. Miller, Jr. (SWD)	Aug. 1995–Nov. 1997
MG Jerry Sinn (NAD)	Jan. 1998–Sep. 1999
COL James R. Hougnon (LRD-GL)	Sep. 1999–June 2000
BG M. Stephen Rhoades (NAD)	June 2000–Dec. 2002
BG Merdith W. B. "Bo" Temple (NAD)	Feb. 2003–July 2005
BG William T. Grisoli (NAD)	Aug. 2005–Sep. 2006
BG Todd T. Semonite (NAD)	Sep. 2006–Apr. 2009
BG Peter A. DeLuca (NAD)	Apr. 2009–Apr. 2012
COL Kent D. Savre (NAD)	July 2012–Mar. 2015
BG William H. Graham (NAD)	Mar. 2015–

Executive Secretaries of the Board on Coastal Engineering Research	
LTC Milton E. Stevens	1964–
COL F.O. Diercks	1964–1966
Joseph M. Caldwell (Acting)	1967–1968
LTC Myron D. Snoke	July 1969–
LTC Edward M. Willis	1969–1971
LTC D. S. McCoy	1971–1973
COL James Trayers	1973–1976
COL John H. Cousins	1976–1979
COL Ted E. Bishop	1979–July 1983
COL Tilford C. Creel	July 1983–Dec. 1985
COL Robert C. Lee	Jan. 1985–July 1985
COL Allen F. Grum	July 1985–July 1986
COL Dwayne G. Lee	July 1986–Mar. 1989
LTC Jack R. Stephens (Acting)	Mar. 1989–June 1989
COL Larry B. Fulton	June 1989–Jan. 1992
COL Leonard G. Hassell	Jan. 1992–July 1993
COL Bruce K. Howard	July 1993–June 1997
COL Robin R. Cababa	Sep. 1997–June 2000
COL James S. Weller	Aug. 2000–July 2001
COL John W. Morris III	July 2001–June 2003
Thomas W. Richardson, Dir, CHL, ERDC, Acting	June 2003–Feb. 2004
COL James R. Rowan	Feb. 2004–July 2006
COL Richard B. Jenkins	July 2006–June 2008
COL Gary E. Johnston	July 2008–Nov. 2010
COL Kevin J. Wilson	Nov. 2010–June 2013
COL Jeffrey R. Eckstein	July 2013–Mar. 2015
José E. Sanchez	Mar. 2015–Dec. 2015
COL Bryan S. Green	Dec. 2015–

Los Angeles California Coast

Appendix C: List of CERB Meetings (1963–2016)

No.	Date	Host	Location	Theme
1st	Apr. 1964	CERC	CERC (DC)	
2nd	Aug. 1964	CERC	CERC (DC)	
3rd	Dec. 1964	WES	Vicksburg, MS	
4th	June 1965	CERC	CERC (DC)	
5th	Oct. 1965	USLS	Port Huron, MI	
6th	May 1966	CERC	CERC (DC)	
7th	Dec. 1966	WES	Vicksburg, MS	
XX	Apr. 1967	WES	Vicksburg, MS	Civilian Board Members only
8th	May 1967	CERC	CERC	
9th	Oct. 1967	USLS	Highland Park, IL	
10th	May 1968	SAD	Palm Beach-Miami Beach, FL	
11th	Oct. 1968	SPD	Long Beach, CA	
XX	Jan. 1969		Vicksburg, MS	Civilian Board Members only
12th	July 1969	CERC	CERC	
13th	Oct. 1969	SWG	Galveston, TX	
14th	Mar.–Apr. 1970	WES	Vicksburg, MS	
15th	Oct. 1970	MIT	Cambridge, MA	
16th	Apr. 1971	WES	Vicksburg, MS	
17th	Oct. 1971	CERC	CERC	
18th	Apr. 1972	NPD	Portland & Newport, OR	
19th	Oct. 1972	SAD	Jacksonville, FL	
20th	May 1973	CERC	Washington, DC	
21st	Oct. 1973	NCD	Chicago, IL	
22nd	Mar. 1974	CERC	Fort Belvoir, VA	
23rd	Sep. 1974	SAD	Wilmington, NC	
24th	July 1975	NED	North Falmouth, MA	
25th	Dec. 1975	SPD	San Diego, CA	
26th	May 1976	CERC	Fort Belvoir, VA	

No.	Date	Host	Location	Theme
27th	Nov. 1976	SAD	Mobile, AL	
28th	June 1977	NAD	New York, NY	
29th	Oct. 1977	SAD	Wilmington, NC	
30th	Apr. 1978	SWD	Corpus Christi, TX	
31st	Oct. 1978	SPD	San Francisco, CA	
32nd	Apr. 1979	SAD	Miami Beach, FL	
33rd	Sep. 1979	NPD	Seattle, WA	
34th	Apr. 1980	NCD	Cleveland, OH & Erie, PA	
35th	Nov. 1980	NAD	Baltimore, MD	
36th	Mar. 1981	SWD	Galveston, TX	
37th	Nov. 1981	LMVD	Vicksburg, MS	
38th	Apr. 1982	SPD	San Diego, CA	
39th	May 1983	SAD	Wilmington, NC	
40th	Oct. 1983	NED	North Falmouth, MA	
41st	June 1984	NPD	Seattle, WA	
42nd	Dec. 1984	NCD	Chicago, IL	
43rd	May 1985	WES	Vicksburg, MS	
44th	Nov. 1985	SPD	San Francisco, CA	
45th	May 1986	NPD	Fairbanks & Homer, AK	
46th	Oct. 1986	WES	Vicksburg, MS	
47th	May 1987	SWD	Corpus Christi, TX	
48th	Nov. 1987	SAD	Savannah, GA	Sea Level Rise
49th	May 1988	NCD	Oconomowoc, WI	Coastal Engineering Implications of Changes in the Great Lakes Water Levels
50th	Nov. 1988	NAD	Virginia Beach, VA	Long-Range Research Needs in Coastal Engineering
51st	May 1989	SAD	Wilmington, NC	Shoreline Erosion and Restoration
52nd	Oct. 1989	SPD	Redondo Beach, CA	Pacific Coastal and Navigation
53rd	June 1990	SAD	Fort Lauderdale, FL	Coastal Inlets

No.	Date	Host	Location	Theme
54th	June 1991	LMVD	New Orleans, LA	Coastal Flood Protection
55th	Oct.–Nov. 1991	NED	Mashpee, MA	Dredging
56th	June 1992	NPD	Newport, OR	Coastal Structures
57th	Oct. 1992	POD	Honolulu, HI	Pacific Islands Coastal Engineering
58th	June 1993	NAD	Atlantic City, NJ	Coastal Data Collection
59th	Nov. 1993	SAD	Point Clear, AL	Coastal Wetlands
60th	Nov. 1994	WES	Vicksburg, MS	Coastal Research and Development
61st	May 1995	SWD	Galveston, TX	Coastal Zone Management
62nd	Oct. 1995	SAD	Fort Lauderdale, FL	No theme (Civilian Board members)
63rd	June 1996	SPD	San Diego, CA	Direction of Coastal Engineering in the Corps and Resulting Impact on R&D
64th	Jan. 1997	SPD	Morro Bay & San Francisco, CA	No theme (Civilian Board members)
65th	June 1997	NCD	Chicago, IL	Coastal Engineering in the Great Lakes
66th	Oct. 1997	NAD	New York, NY	No theme (Civilian Board members)
67th	May 1998	SAD	Fort Lauderdale, FL	Regional Sediment Management
68th	Oct. 1998	NAD/ SAD	Wilmington, NC & Norfolk, VA	No theme (Civilian Board members)
69th	Apr. 1999	POD	Honolulu, HI	Military Applications of Coastal Engineering
70th	Oct. 1999	SAD	Dauphin Island, AL	Regional Sediment Management
71st	June 2000	SPD	Dana Point, CA	Regional Sediment Management
72nd	July–Aug. 2001	SWD	Galveston, TX	Muddy Coasts
73rd	Mar. 2002	NAD	Avalon, NJ	Beach Nourishment Performance
74th	Sep. 2002	ERDC	Duck, NC	Field Data Collection
75th	June 2003	MVD	Lafayette, LA	Louisiana Coastal Area Ecosystem Restoration
76th	Oct. 2003	NWD	Portland, OR	Navigation and Regional Sediment Management in the Northwest
77th	Jun. 2004	LRD	Traverse City, MI	Great Lakes System Management

No.	Date	Host	Location	Theme
78th	Nov. 2004	ERDC	Silver Spring, MD	No theme
79th	June 2005	POD	Anchorage, AK	No theme
80th	Nov. 2005	SAD	St. Petersburg, FL	No theme (emphasis on Hurricane Katrina)
81st	July 2006	ERDC	Vicksburg, MS	Joint meeting with Chief of Engineers Environmental Advisory Board
82nd	Oct. 2006	NAD	Long Branch, NJ	Challenges in Coastal Protection and Restoration
XX	June 2007	NAD/ ERDC	The Netherlands (Fact-finding mission)	
83rd	Sep. 2007	ERDC	Alexandria, VA	Follow up to Fact-Finding Mission to Europe & Implications for USACE
84th	Apr. 2008	SAD	Mobile, AL	Regional System-wide Analysis
85th	Sep. 2008	NWD	Portland, OR	System-based Perspectives of the Coast: A Focus on Pacific Northwest
86th	June 2009	SPD	San Diego, CA	Coastal Data: Requirements and Use
87th	June 2010	NAD	Jersey City, NJ	Climate Change and USACE Mission Considerations
88th	July 2011	LRD	Niagara Falls, NY	Adapting Coastal Systems for the Challenges of the Future
89th	Sep. 2012	SAD	Jacksonville, FL	Regional Sediment Management – Uniting Navigation, Beaches, and the Ecosystem
90th	Sep. 2013	NAD	Long Branch, NJ	Hurricane Sandy – Response, Recovery and Resilience
91st	Sep. 2014	SPD	San Francisco, CA	Coastal System Resiliency – Linking Navigation Dredging, Beneficial Use, Ecosystem Restoration and Coastal Storm Risk Management
92nd	**Sep. 2015**	**SWD**	**Galveston, TX**	**Coastal Navigation – Driving U.S. Economy by Integrating Marine Transportation Infrastructure with Natural Coastal Systems**
93rd	**Aug. 2016**	**SAD**	**San Juan, Puerto Rico**	**A Systems Approach Along Heterogeneous Coasts**

Notes:

1. The concept of "Theme" meetings started with the 48th meeting in 1987 at Savannah.
2. Host organization abbreviations are included in the Glossary of Acronyms (Appendix D of this report).

Appendix D: Glossary of Acronyms

A		
	ADCIRC	Advanced Circulation
	ARSLOE	Atlantic Remote Sensing Land-Ocean Experiment
	ASBPA	American Shore and Beach Preservation Association
	ASCE	American Society of Civil Engineering
B		
	BEB	Beach Erosion Board
	BERH	Board of Engineers for Rivers and Harbors
	BG	Brigadier General
	BSMBE	Board on Sand Movement and Beach Erosion
C		
	CEM	Coastal Engineering Manual
	CERB	Coastal Engineering Research Board
	CERC	Coastal Engineering Research Center, after 1983 part of WES
	CHL	Coastal and Hydraulics Laboratory
	CIRP	Coastal Inlets Research Program
	COE	Corps of Engineers
	COPRI	Coasts, Oceans, Ports, and Rivers Institute of ASCE
	CTH	Committee on Tidal Hydraulics
D		
	DMRP	Dredged Material Research Program
	DOER	Dredging Operations and Environmental Research Program
	DRP	Dredging Research Program

E		
	EAB	Environmental Advisory Board
	ER	Engineering Regulation
	ERDC	U.S. Army Engineer Research and Development Center
F		
	FACA	Federal Advisory Committee Act
	FRF	Field Research Facility
	FRG	Field Review Group
G		
	GITI	General Investigation of Tidal Inlets
H		
	HQUSACE	Headquarters, U.S. Army Corps of Engineers
I		
	ICCE	International Conference on Coastal Engineering
	IJC	International Joint Commission
	IOOS	Interagency Ocean Observation System
	IWR	U.S. Army Institute for Water Resources
J		
	JABLTCX	Joint Airborne Bathymetric Lidar Technical Center of Expertise
K		
L		
	LACPR	Louisiana Coastal Protection and Restoration
	LiDAR	Light Detection and Ranging
	LMN	U.S. Army Lower Mississippi Valley Division – New Orleans District (New Orleans) later renamed MVN

	LMVD	U.S. Army Lower Mississippi Valley Division (later MVD) Vicksburg, MS
	LTG	Lieutenant General
M		
	MG	Major General
	MIT	Massachusetts Institute of Technology
	MsCIP	Mississippi Coastal Improvement Program
	MVD	U.S. Army Mississippi Valley Division (Vicksburg)
N		
	NAB	U.S. Army North Atlantic District – Baltimore District (Baltimore, MD)
	NAD	U.S. Army North Atlantic Division (New York)
	NAN	U.S. Army North Atlantic Division – New York District (New York)
	NAO	U.S. Army North Atlantic Division – Norfolk District (Norfolk, VA)
	NCB	U.S. Army North Central Division – Buffalo District (Buffalo, NY)
	NCD	U.S. Army North Central Division (Chicago) (1 April 1997 USACE reorganized and NCD became LRD – U.S. Army Great Lakes and Ohio River Division (Great Lakes Division and Ohio River Division merged)
	NCE	U.S. Army North Central Division – Detroit District (Detroit, MI)
	NED	U.S. Army New England Division (Boston) (1 April 1997 USACE reorganized and NED became NAE – U.S. Army New England District, part of NAD)
	NGO	Non-Governmental Organization
	NPA	U.S. Army North Pacific Division – Alaska District (Anchorage) (1 April 1997 USACE reorganized and NPA was transferred to the POD and was renamed POA)
	NPD	U.S. Army North Pacific Division (Portland) (1 April 1997 USACE reorganized and NPD became later NWD – U.S. Army Northwestern Division; North Pacific Division and Missouri River Division merged)
	NPP	U.S. Army North Pacific Division – Portland District (Portland, OR) later re-named NWP
	NOAA	National Oceanic and Atmospheric Sciences Administration

O		
P		
	POD	U.S. Army Pacific Ocean Division (Honolulu)
Q		
R		
	R&D	Research and Development
	RSM	Regional Sediment Management
S		
	SAD	U.S. Army South Atlantic Division (Atlanta)
	SAJ	U.S. Army South Atlantic Division – Jacksonville District (Jacksonville, FL)
	SAM	U.S. Army South Atlantic Division – Mobile District (Mobile, AL)
	SAS	U.S. Army South Atlantic Division – Savannah District (Savannah, GA)
	SHOALS	Scanning Hydrographic Operational Airborne Lidar Survey
	SPD	U.S. Army South Pacific Division (San Francisco)
	SPM	Shore Protection Manual
	SWD	U.S. Army Southwestern Division
	SWG	U.S. Army Southwest Division – Galveston District (Galveston, TX)
T		
	TR	Technical Report
U		
	USACE	United States Army Corps of Engineers
	USCG	United States Coast Guard
	USGS	United States Geological Survey
	USLS	United States Lake Survey

V		
W		
	WDD	Wave Dynamics Division
	WES	Waterways Experiment Station (later ERDC)
	WIS	Wave Information System
	WRSC	Water Resources Support Center
XYZ		

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