

**U.S. Army Corps
of Engineers
Coastal and Hydraulics Laboratory**

Minutes

Board on Coastal Engineering Research

**U.S. Army Coastal and Hydraulics Laboratory/Field Research Facility
Duck, North Carolina
14–15 March 2018**

Hosted by U.S. Army Engineer Research and Development Center

Prepared for Headquarters, U.S. Army Corps of Engineers

The Minutes of the Meeting of the Board on Coastal Engineering Research was prepared for the Office, Chief of Engineers, by the U.S. Army Engineer Research and Development Center (ERDC), Coastal and Hydraulics Laboratory (CHL). These minutes provide a record of the papers presented, the questions and comments in response to them, and the interaction among program participants and the Board.

The meeting was hosted by the ERDC. Acknowledgments are extended to the following for overall coordination: Mr. W. Jeff Lillycrop and Ms. Tanita S. Warren from ERDC CHL. Thanks are also extended to Mr. Doyle Jones for summarizing these minutes and to Mr. Tony Tullos for editing. Verbatim transcripts of the meeting are on file at ERDC CHL.

These minutes were reviewed for technical accuracy by Mr. Jeffrey R. Eckstein, Acting Director of CHL, and Mr. W. Jeff Lillycrop, CHL.

The document is approved for publication in accordance with Public Law 166, 79th Congress, approved 31 July 1945, as supplemented by Public Law 172, 88th Congress, approved 7 November 1963.

A handwritten signature in dark ink, appearing to read 'B. S. Green', is written over a horizontal line.

BRYAN S. GREEN
Colonel, U.S. Army
Designated Federal Officer, Board on Coastal
Engineering Research

MINUTES

**Board on Coastal Engineering Research
Executive Session
Coastal and Hydraulics Laboratory/ Field Research Facility
Duck, NC
14–15 March 2018**

The meeting of the Board on Coastal Engineering Research was held at the Coastal and Hydraulics Laboratory/ Field Research Facility in Duck, NC, on 14–15 March 2018.

Attendees

Board Members: BG Diana M. Holland, Commander, South Atlantic Division; BG D. Peter Helmlinger, Commander, South Pacific Division; Dr. Falk Feddersen, Scripps Institution of Oceanography; Dr. Nicole Elko, Elko Coastal Consulting; Dr. Robert Holman, Oregon State University.

U.S. Army Engineer Research and Development Center (ERDC): COL Bryan S. Green, Designated Federal Officer and acting Chair, and Dr. David W. Pittman, Director

ERDC/Coastal and Hydraulics Laboratory (CHL): Mr. Jeffrey R. Eckstein, Acting Director; Dr. Thomas Massey; Dr. Julie Rosati; Dr. Jeffrey Waters; Mr. W. Jeff Lillycrop; Dr. Jane M. Smith; Dr. Katherine Brodie; Ms. Mary Cialone; Dr. Cary Talbot; Mr. John H. Winkelman; and Ms. Tanita S. Warren

ERDC/ Environmental Laboratory: Dr. Ilker Adiguzel, Director

North Atlantic Division: Mr. Lawrence J. Cocchieri; Ms. Julie Ziino, and COL Leon Parrott

New England District: Mr. John H. Winkelman

South Atlantic Division: Mr. Richard D. Davis

Institute for Water Resources: Mr. Doug Bellomo

Los Angeles District: Ms. Heather Schlosser

Guest: Ms. Bianca M. Charbonneau, University of Pennsylvania

Meeting

COL Bryan S. Green, Designated Federal Officer, Executive Secretary of the Board, and acting Chair, called the meeting to order.

BG D. Peter Helmlinger, Commander, South Pacific Division, assumed the administrative roles, to facilitate the meeting in the absence of MG Donald Jackson Jr., President of the Board on Coastal Engineering Research (hereafter referred to as the Board).

Review of Board Action Items

Mr. Jeff Lillycrop provided an overview of the agenda for the 2-day meeting. Lillycrop also noted that the 50-Year History of the CERB compiled by Ms. Joan Pope would be distributed.

Mr. Lillycrop categorized the action items as follows:

1. Those addressed in the Executive Session in Hawaii in 2017
2. Those items in progress
3. Those originating from the Executive Session in Hawaii.

Action Item 1: **Determine project information region by region.** What are the projects? What are the vulnerabilities in a particular region? The Coastal Systems Portfolio Initiative (CSPI) database exists, which contains federal project information. The National Shoreline Management Study is the best method to manage this information and properly answer the questions posed.

Action Item 2: (a) **Examine the available data coming from post-storm and coastal activities.** (b) **What data sets were used following hurricane Matthew?** The data sets contained information concerning waves, water levels, and elevations. Wave information is the Wave Information Study (WIS) and Coastal Data Information Program (CDIP). Water level information comes from the NOAA CO-OPS, NOAA Digital Coast, USGA 3-D Elevation Program and the Joint Lidar Center located in the Mobile District. Lillycrop stated that these data sets were specific to the United States.

Action Item 3: **Summary of the coastal budget.** There is not a coastal line item in the federal budget. The Civil Works Research, Development and Technology portfolio is composed of General Investigations, O&M and Construction lines all within Civil Works. The research areas that exist within these are (a) Navigation, (b) Flood and Coastal, and (c) Environmental. Individual programs are (a) Dredging Operations and Environmental Research (DOER), (b) Coastal Inlets Research Program (CIRP), (c) Regional Sediment Management (RSM) Program, (d) Dredging Operations and Technical Support (DOTS), (e) Monitoring Completed Navigation Projects (MCNP) Projects, (f) Flood and Coastal Systems, (g) Coastal Field Data Collection (CFDC), (h) Coastal Ocean Data Systems (CODS), (i) Ecosystem Management and Restoration, (j) Aquatic Nuisance Species, (k) Aquatic Plant Control, and (l) Water Operations Technical Support (WOTS).

There was a lengthy discussion about the amount of funding spent on coastal R&D and how it advances the value of the products of coastal engineering and coastal science research. A question arose about how much funding would have been focused on

priorities identified by the CERB and how much would have been invested regardless of what the CERB recommended. Mr. Lillycrop stated that more investigation will be required and that a report will be made at the next full meeting of the CERB. A question was asked about how much of supplemental appropriations that come after a storm would be directed to research and if there were any guidelines directing specific amounts to research. Mr. Lillycrop replied that the Corps does not receive any direct research funds from supplemental appropriations.

Research area review groups (RARG) meet annually and review statements of need from Corps districts. This list of priorities is then reviewed by upper level management in the Corps giving us research mandates. Another advocate for coastal research needs is the Coastal Working Group.

It was asked if the Corps had long-term plans approximately 10 years in length — devoted to complex basic research. Lillycrop replied that research on inlets and dredging were two areas that had long-term commitments. These long-term research areas were divided into more specific areas of interest, which last for a 3- or 4-year cycle to ensure products being generated. A key to good results was to maintain focus and ensure that we are being responsive to the districts and their needs.

Action Item 4: **Peer-reviewed publications.** Dr. Jane Smith reported that during FY2017, 26 of the 38 peer-reviewed journal papers and book chapters from CHL were devoted to the coastal discipline. An important aspect of peer-reviewed journal papers and book chapters was the impact to the field. It was noted that technical notes and other publications were used broadly by the engineering community

Action Item 5: **University collaborations.** There are approximately 14 different contracts with 11 different universities totaling approximately \$4.5 million. Other collaborations with universities are serving as adjuncts at 10 different universities and on master committees.

Action Item 6: **Summarize other agency enterprise tools and systems.** This is a very broad topic, and more time needs to be spent understanding the intent of this issue. It was suggested that a summary of enterprise tools and systems rather than a detailed list might be appropriate.

Action Item 7: **Develop a facility on the Pacific Coast of the United States similar to the Field Research Facility (FRF) at Duck, NC.** It was noted that this was a very good suggestion but that developing a new facility on the West Coast might not be practical. It was noted that some processes differ from one coast to the other and the differences should not be missed. Dr. Smith noted that in some cases data are available from the West Coast, but additional experiments may be needed. Dr. Chris Massey of CHL has developed a good method to operationalize and sustain our coastal models.

Action Item 8: **Was there DOD guidance on what percentage of research should be basic research?** Mr. Lillycrop said that there is no specific Army guidance or DOD guidance on what percentage of the R&D budget should be directed towards basic research. It was determined that the Army spends approximately 19 percent on basic research, ERDC military programs spend approximately 5.5 percent, and Civil Works spends approximately 5 percent. This indicates that a large portion of R&D is applied research.

Overview of the Coastal and Hydraulics Laboratory (CHL) Field Research Facility (FRF)-Dr. Jeff Waters

The FRF began operation in 1973 with its prior use as a Naval bombing range. Dr. Waters provided a brief history of the development of the FRF, measuring sensors, and data gathering activities. Waters noted the efforts to move all of the data into the FRF data integration framework (DIF) to make it available to all interested researchers. Waters noted that the FRF efforts involved both civil works and military funding.

Dr. Feddersen noted that the FRF was the premier location in the world for nearshore processes research.

R&D Technologies Supporting Hurricane Preparation, Response and Recovery Dr. Julie Dean Rosati

Dr. Rosati discussed products/tools that were applied to hurricanes Harvey, Irma, and Maria in 2017 assisting in evacuation and emergency operations. These storms caused approximately a \$300 billion impact on the economies of the area affected.

Tools used were the following:

1. Coastal Hazards Rapid Prediction System (CHRPS)
2. Lock Operations Management Application (LOMA)
3. Automatic Information System (AIS)
4. Gridded Surface-Subsurface Hydrologic Model (GSSHA)
5. Coastal Hazard System (CHS).

Rosati noted the Corps is attempting to apply the coastal tools more into the emergency operations assessment protocol. Rosati noted that it was of great importance to update guidance documents and transmit them to Corps district offices

Rapid Storm Surge Forecasts – Dr. Julie Rosati

Dr. Rosati discussed the state of practice in storm surge forecasting, especially the uses of the SLOSH, CHRPS, and C-Storm Modelling System numerical models. Rosati also discussed the use of the Coastal Hazard System (CHS) that would allow quicker predictions from a pre-calculated database. It was noted that the next steps were to expand CHS and CHRPS for nationwide coverage. Also, the areas of Hawaii and Alaska will be addressed for storm forecasting and database creation.

U.S. Coastal Research Program: Storm Processes and Impacts
Ms. Mary Cialone

The Storm Processes and Impacts workshop will take place in St. Petersburg, FL, 16–18 April 2018. The goal of the workshop is to assemble coastal experts from academia, government, industry, and non-government organizations and to reach a consensus of present capabilities for modeling storm processes and impacts forecasting the future. Where should we focus research needs for the future? It is necessary to transition research findings into usable information for emergency managers and the general public before storm events and during the recovery period, and also, how to approach the challenges with present scientific knowledge. The follow up to the workshop is the During Nearshore Event Experiment (DUNEX).

U.S. Coastal Research Program: During Nearshore Event Experiment (DUNEX)
Ms. Mary Cialone

Ms. Cialone stated that the motivation for DUNEX is to advance the understanding of storm processes, which will improve our ability to calculate storm processes, to incorporate better representation into our numerical models, and to identify gaps in our knowledge that will help create additional research collaborations between the federal government and academia. The scheduled target for DUNEX is 2020.

Numerical Technology Modernization Plan – Dr. Thomas C. (Chris) Massey

Dr. Massey provided an update on the work in progress on the Numerical Technology Modernization Plan. The charge from the Chief of Engineers was to develop a strategic plan to manage and maintain Corps models from creation in an R&D capacity through production, use, and model retirement. An important issue was the marketing strategy for the models.

A strong emphasis of this effort is the reuse of code examining areas of overlap, data storage, access of source code, verification, validation, uncertainty quantification, tool interface, common branding at ERDC, and models that communicate with each other. Massey noted that this effort involved the Environmental Laboratory (EL) and software engineers from the Information Technology Laboratory (ITL), both at ERDC. Progress in all of these areas has been accomplished, but much more work will be needed in the future. An important aspect of this effort is quantifying uncertainty, which is a difficult task.

Questions arose about the funding of this effort. It was noted that departmental overhead was the source of some of the funding.

Coastal Guidance: Pilot Study – Mr. John Winkelman

Mr. Winkelman noted that this topic was a result of a request made at the Executive Session of the CERB held in Hawaii in 2017. Winkelman noted that the last significant

guidance document in coastal was the Coastal Engineering Manual (CEM), which is approximately 20 years old. The CEM and its predecessor, the Shore Protection Manual (SPM), is frequently used by coastal engineers. Several years will be required to develop a new document, and several years will be necessary to pass through the review and approval process. Winkelman noted that the CEM was a huge compendium of coastal knowledge stating "what can be done rather than what should be done." Engineering construction bulletins, engineering technical letters, and engineering circulars, all which have a designated shelf life, are relatively short in length and reach publication much sooner than more formal guidance. The task to be faced is collecting the science, interpreting it, producing guidance, and getting it approved and distributed.

It is very important to speed the process of review and approval of guidance documents to make the entire process more efficient. It might be possible to have more involvement with the Coastal Community of Practice (CoP) to help with these processes. Questions arose about how high a level in the bureaucracy was needed for approval of the Pilot Study. It was also noted that there is a risk of guidance being issued prematurely. Col Bryan Green suggested that the Army has solved some of the problems with version control. Software exist to time stamp the version of the guidance updates. There are several web-based tools that could be of use in this endeavor.

Strategic Tech Transfer and Training – Dr. Jane M. Smith

Dr. Smith noted the importance of distributing cutting-edge scientific coastal products and implementing their engineering use in Corps field offices technology transfer. It was important to reach agencies outside the Corps and the practicing coastal engineer. Smith noted that there is no CHL-level technology transfer procedure and it would be advantageous to have a lab-unified method of distribution. CHL has used and is using several procedures to transfer technology, but these methods are not integrated at the lab level. Smith referred to the model integration efforts that were discussed in Dr. Massey's presentation earlier in the Executive Session. It is important to track what is being transferred, who is receiving the transfer, and how many times it is being transferred. It was noted that one aspect not measured was the impact that the technology transfer generated.

Coastal Processes R&D Needs: 94th CERB – Dr. Jane M. Smith

Research Items Identified at the 94th CERB Meeting

1. Sediment Placement
 - a. Carbonate beaches
 - b. Sediment/coral reef interactions
 - c. Strategic dredged material placement
2. Wave Transformation over reefs
 - a. Roughness
 - b. Width
 - c. Irregularity
 - d. Porosity

- e. Wave reformation
- f. Infragravity wave generation
- 3. Expansion of hazard databases
 - a. Coastal Hazards System (CHS)
 - b. Wave Information Studies (WIS)
- 4. Integrated system modeling across time/space scales
 - a. Hydrodynamics
 - b. Sediment/morphology
 - c. Environmental
 - d. Social/Cultural
 - e. Decision support

Coastal Working Group Annual Meeting Overview and Top Research Needs 2018 Mr. John Winkelman

Mr. Winkelman provide a brief review of the Coastal CoP meeting held in Portland, OR, in November 2017. Winkelman discussed the top research needs developed at the Coastal CoP meeting. The statements of need were categorized by business line and by topic.

The top research needs in 2018

- 1. Natural and nature-based features and engineering with nature
- 2. Risk (event probability and project performance vs consequences)
- 3. Dredging and beneficial reuse
- 4. Numerical tools efficiency
- 5. Infragravity waves

BG Helmlinger asked, "How does the CERB interact with the priorities listed by the Coastal CoP?" Mr. Lillycrop stated that Mr. Winkelman could present the most important priorities to the research area review group (RARG). Because the priorities would come from the CERB, a substantial amount of weight for the RARG would be created. Dr. Elko stated that she would like to see priorities expressed in greater details (i.e., shore protection and storm damage reduction). BG Helmlinger noted that he did not see coastal guidance documents listed in the priorities. Mr. Winkelman noted that more and better guidance was an issue in each of the priorities but did not appear as one of the initial descriptive words. Guidance is a product of research.

Coastal Asset Management Update – Mr. Dylan Davis

Mr. Davis noted the three subgroups of the Corps Asset Management, which are separate but definitely integrated. These are funded by the Harbor Maintenance Trust Fund (HMTF).

- 1. Navigation Structures
- 2. Navigation Channels
- 3. Coastal Storm Damage Reduction (CSDR) Structures

Davis noted that ERDC was heavily involved in all three areas with data and models. Tools that are designed for one subgroup often will have applications in the other subgroups.

Navigation Structures: It is necessary to catalog more than 1,000 existing structures with their locations, rating of their condition, and most importantly, rating their functionality. Understanding the risks involved that influenced decisions to be made concerning these structures was the desired outcome.

CSDR involves the evaluation of beaches and their re-nourishment cycles. A serious consideration is the benefits of the beaches and not just the condition of the beaches. The primary tools used to evaluate navigation channels are eHydro, Corps Shoaling Analysis Tool (CSAT), and Channel Portfolio Tool (CPT). These tools help to answer the questions about the timing of dredging in a channel, the cost of dredging, and traffic within a channel. CSPI helps to investigate beaches studying both benefits and associated costs.

Nearshore Processes Update – Mr. Jeff Lillycrop

The nearshore processes initiative began approximately 2014, and its purpose was to bring the nearshore community and the coastal community together involving federal and non-federal agencies, academia, and industry to begin working together as a community effort. This effort was initiated by the American Shore and Beach Preservation Association (ASBPA) and is known as the U.S. Coastal Research Program. The first task was to identify coastal research activities, which were then subdivided into three categories: (1) episodic events, (2) long-term coastal change, and (3) human and ecosystem health related issues. One of the first events was conducting a national dune management workshop that helped to prioritize research topics. These collaborations helped to create some efficient working relationships. Many details have not been finalized, but great progress has been achieved to this point. Lillycrop noted in closing that the group would review the research every 5 years and make modifications as needed. Lillycrop also added the CERB was a strong proponent of these research initiatives.

Coastal Dune Research Supported by the U.S. Coastal Research Program Dr. Julie Dean Rosati

The initial workshop held in November 2015 was under the direction of ASBPA. Six proposals were developed by this workshop.

1. Oregon State University – Peter Ruggiero
2. University of North Carolina – Laura Moore
3. North Carolina State University – Beth Sciaudone
4. University of Alabama – Doug Sherman
5. University of Arizona – Ian Walker
6. University of Pennsylvania – Brenda Caspar

Dr. Rosati provided an overview of each of these research projects. Some findings were presented at the ASBPA convention in the fall of 2017, and some of the research is being completed in 2018, and final results are in progress. A possible next step is to communicate these findings to the Coastal Working Group of the Corps. Also, communication with the local stakeholders will help them understand the value of the research findings.

A question was posed about the International Conference on Coastal Engineering (ICCE) to be held in Baltimore, MD, in the summer of 2018. Dr. Smith replied that one afternoon of the conference would be devoted to a town-hall format discussing the future of coastal engineering and this might be excellent time for someone to discuss research areas of interest from the Corps. A question was raised about the possibility of longer research proposals. Dr. Rosati noted there is great value in having very confined and much-focused research of finite duration. Rosati noted the issues of multi-year funding as it is related to contracts

Wind Tunnel Tests of How Plants Feedback on Dune Shape Ms. Bianca R. Charbonneau

Ms. Charbonneau provided a detailed description of her research at the University of Pennsylvania. The research involved coastal dune ecology in regard to how dunes recover in the event of storms. Ms. Charbonneau discussed how certain species of dune plants helped to maintain dunes by having roots that bind sand and by having shoots that act as obstructions to blowing sand on the surface. Plants act as ecosystem engineers in a dune environment modifying, building, and maintaining their habitat. The study involved several species of plants that involved several different statues of plants and their relationship to the efficiency of sand capture. Ms. Charbonneau concluded that density of obstruction did not affect bedform accumulation but biomass and species did affect bedform accumulation and shape.

Dune Evolution on Storm through Decadal Time Scales along the North Carolina Outer Banks – Dr. Katherine Brodie

The motivation for this research is coastal foredunes, which are dynamic features eroding during storms offering coastal protection and then reforming themselves from natural processes. Questions of high interest are “how much dune erosion can be expected during a storm” and “how to design a dune that offers the maximum protection during a storm?” Other important issues are “how fast do dunes grow” and “can long-term dune evolution be simulated?” The answer to the latter question is influenced by looking ahead at years to decades for protection planning. Where is the optimum location for sand placement in the system? Dr. Brodie provided findings from storms that had effects on beaches and dunes at the Outer Banks of North Carolina. Brodie explained data gathering efforts on coastal dunes and lessons learned from modeling efforts.

An important research question was "can long-term dune evolution be simulated?" FRF personnel will be working to help answer that question adequately. Brodie noted that the study of the erosion and accretion processes related to dune is complex and difficult to predict at the present. Some tools are available for prediction of changes to dunes, but it is hopeful in the next few years to have better tools with less uncertainty. As always, funding and sources of research funding are very important considerations.

Questions arose about opening and closing of inlets. Brodie replied that the outer banks of North Carolina was a wave-dominated coastline that produces long, narrow barrier islands with inlets. It was noted that barrier islands located from South Carolina and Georgia were tidally dominated, which produced larger and more stable tidal inlets.

Plans for the 95th CERB Meeting – Mr. Jeff Lillycrop

The 95th CERB Meeting is scheduled be held at Providence, RI, 7–9 August 2018. The title of this meeting is "Coupling Coastal Engineering Solutions with Social and Ecological Predictions." The Executive Session in the winter or spring of 2019 will take place at Corvallis, OR. The 96th CERB public meeting in 2019 will be held in Washington, DC, with the focus on "Urban Flooding." BG Helmlinger asked if the 2021 CERB meeting with a scheduled topic of "Dredged Material Management" could be moved to 2019 because General Semonite has noted the high priority of that topic. Mr. Lillycrop said that it would be possible to switch topics for 2019 and 2021.

Public Comment

COL Green noted that there were no submissions for public comment and no one appeared.

Discussion and Final Board Comments

Dr. Feddersen noted that it was very important to increase the fraction of the overall civil works budget that goes to R&D. Feddersen noted the recent strong emphasis in applied research is getting things done, addressing the issue and finding a solution in 1 to 3 years. Feddersen noted that basic research required a longer period of time and did not always have a tangible product. Feddersen added that there needs to be a re-embracing or re-appreciation of basic research and this is not unique to the Corps of Engineers.

Dr. Elko stated that it had become evident that there is a need within the Corps to educate leadership beyond the CERB about the importance of increasing the understanding of coastal processes, beach and dune systems, and publishing the vital benefits that are associated with that, understanding the improved resilience for better projects. Elko noted that to keep the Corps a world leader in coastal science and engineering, it is necessary to continue with nearshore processes research. Elko also noted the need for updated guidance in the areas of coastal science and coastal engineering. Elko stated that the model modernization process getting models open-

sourced was vital in the collaboration with universities. Elko noted the need for increased funding for studies in coastal science and engineering. Elko asked if additional information about research funding for other federal and non-federal agencies could be provided.

BG Holland noted that the outcomes of the CERB meetings, the priorities should be articulated in a method that will help move us forward.

Dr. Holman noted that the value of assets we are trying to protect, manage, or build is huge and we should be bolder in what we are doing in these areas.

Dr. Smith asked, "What procedure should be followed for the Corps to increase the percentage of funds that go to research?"

BG Helmlinger stated that it was necessary to overcome our short-term vision and look more at the long term.

Closing Remarks

COL Green thanked everyone for attending the meeting.

Action Items

1. Advancing our coastal guidance pilot effort.
2. Bring attention to the carbonate beaches.
3. West Coast test pad similar to that of the current FRF.
4. Increase the definition and categorization of natural and nature-based features.
5. Explain the civil works business process. Suggest that it should be a few minutes with a couple of slides.
6. Examine the CERB recommendation and determine how they influenced the Corps and provided value.
7. Determine the number of publication per research funding.
8. Present the coastal guidance pilot at an upcoming executive governance meeting of Corps senior leaders.
9. What is the impact of research not being in supplemental appropriations?
10. Become more familiar with the vegetation dune research being performed by Bianca Charbonneau.
11. Move the Dredging Management topic to the CERB public meeting in 2019.

COL Green reviewed the action items from the meeting followed by the meeting adjournment of the Board on Coastal Engineering Research.