Minutes of the 108th Meeting

21-23 September 1999

Executive Summary

The U.S. Army Corps of Engineers Committee on Tidal Hydraulics (CTH) met in Vicksburg Mississippi on 21-23 September 1999 at the Corps of Engineers Engineer Research and Development Center (ERDC).

The Technical Session on Coastal and Tidal Hydraulics Research and Development programs and specific reimbursable projects consisted of presentations by research and modeling personnel from the Coastal and Hydraulics Laboratory (CHL). R&D Program overviews of the Dredging Operations and Environmental Research (DOER) program, Coastal Inlets Research Program (CIRP), Coastal Navigation and Storm Damage Reduction Program, the Hydro-Environmental Modeling System, and Hydraulic Design of Wetlands were presented. Details of numerous Tidal Hydraulics Projects, the modeling effort of the South Florida Restoration Project, the Panama Canal Salinity Intrusion Study, the Military Ocean Terminal, Sunny Point (MOTSU), and the Providence River Navigation Study were also presented. The reengineering of USACE R&D and the Water and Sediment Research Macroplan were discussed and a proposal for documenting and describing 3D numerical models was introduced.

In executive session the CTH considered the questions presented by the presenters and established a sub-committee to prepare a response. Other business included a discussion on proposed tidal hydraulics workshops.

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1. The 108th meeting of the Committee on Tidal Hydraulics (CTH) was held 21-23 September, 1999 at the Corps of Engineers Engineer Research and Development Center (ERDC) in Vicksburg, Mississippi.

2. Technical Sessions on Coastal and Tidal Hydraulics Research and Development programs, and specific reimbursable projects were held on 21 Sep, the morning of 22 Sep, and one hour on 23 Sep 1999. The CTH held Executive Sessions on the afternoon of 22 Sep and the morning of 23 Sep 1999. All sessions were held in the Coastal and Hydraulics Laboratory (CHL).

3. Attendees were:

Committee on Tidal Hydraulics

William H. McAnally, Chairman	ERDC, Coastal and Hydraulics Laboratory
Virginia R. Pankow, Executive Secretary	Water Resources Support Center
A. Jay Combe	New Orleans District
Jaime R. Merino (1)	South Pacific Division
Eric E. Nelson	Seattle District
Michael R. Palermo (2)	ERDC, Environmental Laboratory
Todd L. Walton	ERDC, Coastal and Hydraulics Laboratory
Charles J. Wener	New England District
David B. Wingerd, Liaison	Headquarters, U.S. Army Corps of Engineers

Consultants

Frank A. Herrmann, Jr.	Vicksburg, MS
Ray B. Krone (3)	Professor Emeritus, University of California at Davis
Ashish J. Mehta	Professor, University of Florida

Corps of Engineers Presenters and Guests (4)

James R. Houston	Director, CHL
Michael Alexander	CHL
Charles Berger	CHL
William Boyd	CHL
Barbara Donnell	CHL
Jeffrey Holland	CHL
Carolyn Holmes	CHL
Nick Kraus	CHL
Joseph Letter	CHL
Rob McAdory	CHL
E. Clark McNair	CHL
Trimbak Parchure	CHL
Michael J. Trawle (5)	Vicksburg, MS

(1) Attended days 2 and 3.
(2) Attended day 1.
(3) Attended days 1 and 2.
(4) Technical Sessions Only
(5) Attended day 3 MOTSU Discussion

4. The minutes are divided into discussions of presentations made at the Technical Sessions and actions taken at the Executive Session. The order of the minutes is not necessarily the chronological order in which these matters were considered at the meeting.

TECHNICAL SESSIONS

5. Dr. William H. McAnally opened the 108th meeting of the Committee on Tidal Hydraulics at 0830. He announced a rearrangement of the schedule to accommodate Committee members who had overlapping commitments.

6. Dr. James R. Houston, Director, Coastal and Hydraulics Laboratory welcomed the Committee and remarked that he was unaware of any other committee that has had 108 meetings.

7. Dr. Houston presented an overview of the reengineering of the USACE Research and Development organization. The objective is to have improved program execution through a more integrated laboratory organization. The Engineer Research and Development Center (ERDC) contains all the Corps laboratories: Coastal and Hydraulics Lab (CHL), Environmental Lab (EL), Geotechnical Lab (GL), Structures Lab (SL), Information Technology Lab (ITL), Cold Regions Research and Engineering Lab (CRREL), Construction

Engineering Research Lab (CERL) and Topographic Engineering Center (TEC). The combining of support organizations, i.e. logistics, contracting, etc. has enabled the mandated R&D position cuts to be effectively handled. Last year all the support organizations were combined with a different support center located at each of the lab sites. In some cases it is proving to be an improvement. This distributed leadership will reduce redundancy among the labs and achieve all manpower cuts while reducing costs by the year 2003. The Director of ERDC will not be a part of Corps Headquarters. The office will be located at Fort Belvoir, Humphreys Engineer Center, and report to the Deputy Chief of Engineers. The eight labs will report to the Director, who has not yet been selected. There will not be a Waterways Experiment Station (WES) Director. Additionally SL and GL will be combined when the current SL Lab Director retires. The majority, over 80% of all lab money is military with only 20% attributed to Civil Works projects. The reengineering of the lab system is designed to support the project management concept. Second line managers (Division Chiefs) will be reinvested into program and project management. CHL has been reorganized from seven to four Divisions which, due to an upcoming retirement, will be reduced to three. It is anticipated that the final round of reorganizations will have one Division in the lab plus a Program Management Office.

8. Discussion and Questions

Q. How has this effected the troops?
A. In day-to-day operations so far not very much. In the long term it will effect how we figure overhead burdens. Currently each lab does it different. The only legal way is that all burdens are against labor. We propose burdens on labor, purchases, contracts and travel.

Q. What effect will this centralization of support organizations have? It seems inefficient to not have support co-located with the user.
A. The WES experience with personnel was some degradation of service. The new system will effect the other lab sites to some degree.

Q. How will the new personnel demo program pay system effect personnel?
A. With the changeover in leadership there will be uncertainties and it will have an impact on how to manage R&D.

Q. Are you pushing more video conferencing?
A. Definitely, however it takes twice as long and is not as efficient. The new lab structure has resulted in more travel for lab Directors. There are monthly and quarterly meetings. We are also using conferencing with individual PCs.

Q. Are you using the CEAP network? We find it slow.
A. The video conferences use phone lines and the PC conferences use the Internet. Things are improving.

Q. How has this effected the customer? Is there confusion?
A. Not yet, as they haven't seen a difference. Most times, at least in CHL, the principal investigator (PI) and the District point of contact (POC) communicate directly.

9. Dr. William H. McAnally briefed the Committee on the Water and Sediment Research Macro Plan. A draft copy of the plan (U.S. Army Corps of Engineers Water And Sediment Management Research and Development Macro Plan) was supplied to each member. The concept is to establish a global view of how R&D should be defined in a particular subject area. A HQ initiative, the draft was prepared by a team whose members represented all Corps laboratories. The Macro Plan is based on defined customer needs as identified in vision workshops held early in the process. In addition to the Water and Sediment Management Macro Plan, other teams prepared plans for the areas of Environmental Quality and Infrastructure. The draft plans have been revised and re-submitted to HQ for further review and action.

10. Discussion: When questioned on how the plan was to be used, Dr. McAnally indicated the plan will focus on what changes need to be made to improve the program and it will be used by HQ to make investment decisions - a top down review. A comment was made that the R&D strategic plans align with the overall strategic plan for the Corps. However, the Corps does not always think in a strategic way. Research is more applied, a right now solution to today's problems. The Districts have a critical need for today's solution. This will always be a need and will never go away. The Corps needs to look ahead to identify and solve future problems. We need a forward looking capability in the Divisions. Tactical research will always be required but we should also be proactive. Maybe the macro plan does this. The CTH has always wrestled with this problem. People doing the work need to be involved in the research. A top down decision in R&D is not necessarily good.

11. Internal Corps and external customer needs must be met. Design manuals should be developed before implementation. The engineer needs the manual. As an example, the Shore Protection Manual is one of the most important documents the Corps has produced, it is used world wide. There should be research to develop design manuals. This is being done in the dredging area. Three EM's are being consolidated into one. The product will contain a great amount of detail and will be available on the Internet. There are problems in combining and updating manuals, it is a massive effort. There is a 5 year program to update and consolidate the EM's and reduce the number of manuals. This has had a positive impact in that we have been forced to reorganize and integrate the information. Good progress has been made, however, funding has become a limiting factor. The basic Coastal Engineer Manual is free to everyone; however a PC-based interactive version is free only to the Corps but now has a cost for private industry, educational institutions and all non-Corps users. This is a result of a Cooperative Research Agreement in which a Corps product is enhanced by a private company, at their expense, with proceeds from the sale being their compensation. Most non-enhanced products will be available on the Internet.

12. Mr. E. Clark McNair, Program Manager of the Dredging Operations and Environmental Research Program (DOER), summarized the objectives and activities of the program. DOER is the largest single direct allotted R&D program in the Corps. Started in 1997, it is O&M funded ($48 million) and has a projected life of 8 years. The program involves several labs and includes CHL, EL, GL, and TEC with economic expertise from the Institute for Water Resources (IWR). Clark McNair (CHL) and Bob Engler (EL) are co-managers.

Programs such as the Dredged Material Research Program (DMRP), Improvement of Operations and Maintenance Techniques (IOMT), and the Dredging Research Program (DRP) had separate and different focuses. DOER employs a holistic approach to consider all aspects (environmental, regulatory, physical processes and equipment) of the dredging process. The needs of the District were sought and formed the foundation of the program. Over 300 suggestions and needs were identified. These were winnowed into 6 major areas: contaminated sediments, environmental windows, innovative technologies, instrumentation, nearshore/aquatic placement and risk.

13. The discussion that followed identified risk as such things as ecological, engineering, weather, and economic impacts. The Internet will be the primary means of disseminating information in the form of short technical notes rather than manuals. It was recognized that the Corps and EPA have different missions and frequently use different models. The need for coordination and interagency agreements especially in the areas of models and testing was stressed. In New England Division work with EPA involves superfund more often than navigation work. Testing can be a sensitive issue. If sediment specific and cheap screening procedures can be developed to identify the clean from the contaminated sediment, then only the contaminated material needs more extensive testing. When questioned about the possibility of program time and cost changes, Mr. McNair indicated the $48 million funding will not change, but since the annual level of funding has varied from the original plan, it may take more time to complete the work.

14. Dr. Nick Kraus presented information on the Coastal Inlets Research Program (CIRP). The Committee members were given a copy of the presentation slides as well as copies of several published papers describing different program products. CIRP is a $20 million program managed by Clark McNair and Nick Kraus. The object is to study coastal inlets and adjacent beaches as a system to identify ways to more effectively and efficiently operate and maintain these navigation channels. The models used in CIRP have proven that boundary conditions and correct bathymetry are essential. A regional grid is frequently needed to assure correct boundary conditions for the study area. A steering module is being developed to control and establish interactions (as through the wave-current interaction) among models if more than one model is needed. The ability to visualize results was demonstrated with a surface water management system (SMS) animation of geomorphic changes at Willapa Bay, WA and a film loop of tidal circulation at Shinnocock Inlet, NY using the regional (New York Bight) grid.

15. The focus areas of CIRP are:

a. Inlet Channels and Adjacent Shorelines - products are PC based models to perform sediment budget analysis, morphology modeling, a PC based handbook of inlet experiences and a method to analyze LIDAR data.

b. Inlet Modeling System (IMS) - random wave model and tidal circulation model, steering module, coupled wave, current, and sediment transport-morphology change models for inlets,, training sessions, completed regional models of the New York Bight and the Pacific Northwest.

c. Scour at Inlet Structures - causes of scour and simple measures to estimate scour, movable bed modeling techniques and a PC program for estimating jet action induced scour.

d. Inlet Geomorphology and Channels - Documentation of historic conditions at selected inlets; quantitative inlet geomorphology models such as of inlet channel stability, spit evolution, and channel infilling; integrated study of inlet geomorphology, including orientation of channel, ebb shoal size and symmetry, and limiting depths and slopes.

e. Inlet Laboratory Investigations - mitigation method for inner-bank erosion, data sets for wave current interactions, spit formation, and inlet channel stability, random wave diffraction; and sediment pathways.

f. Inlet Field Investigations - long term data sets of waves, tidal currents and water levels, robust acoustic measurement systems, and 'HYPAS' analysis and visualization software.

g. Technology Transfer - Workshops, Tech Notes, PC bases programs, Web pages annual CIRP-supported student-seminar.

16. The discussion that followed emphasized the value of the visualizations in demonstrating model results to sponsors and resource agencies. Much of the massive amount of data being used in the CIRP was obtained from work done in the DRP. When questioned if the Inlets program models which use sediment mixtures and sediment transport, could be used to predict sediment deposition, Dr. Kraus indicated that the program was not addressing sediment mixtures at this time.

17. Ms. Carolyn Holmes reviewed the Coastal Navigation and Storm Damage Reduction Programs supporting the Corps' coastal missions. The programs are developing engineering technologies that reduce the costs of planning, designing, constructing, maintaining, and operating navigation projects at entrance channels and harbors, and coastal structures built for those navigation projects, as well as flood-damage reduction works. The Corps' coastal infrastructure includes about 800 navigation projects and 100 coastal storm damage reduction projects, with more than 400 miles of breakwaters and jetties. The research area is organized into three major programs, each containing several work units.

a. Coastal Navigation Hydrodynamics Program develops technologies required to define, measure and predict waves, currents, and water levels required to plan, design, operate and maintain safe and efficient coastal-navigation and storm damage reduction projects; and develops design guidance for deep- and shallow-draft navigation channels where waves are critical elements. Activities include conducting long-term coastal data at the Field Research Facility in Duck, NC and base measurements for multi-agency field activities at the Duck facility.

b. Coastal Sedimentation and Dredging Program studies the physics of sediment transport and develops technologies to define and predict sediment transport processes and channel shoaling and design guidance required for cost-

effective dredging operations, and design and maintenance of coastal channels. The use of a PC based application to predict sand and bypassing cost and performance are also part of this work.

c. Coastal Structures Evaluation and Design Program develops technologies and guidance to design, build and maintain coastal navigation projects and structures. A major effort in this program is the development of the Coastal Engineering Manual, a state-of-the-art comprehensive replacement of the Shore Protection Manual. The CEM will incorporate the basic principles of coastal processes, methods for computing coastal engineering planning and design parameters and guidance on how to formulate and conduct studies in support of coastal navigation and storm damage reduction projects.

18. Discussion: Data on coastal structure deterioration is generally gathered by an experienced PI during site visits. Also discussed was whether or not people are using the Internet to get the information. Before (Internet) one would get information on paper and generally found time to read it. Some readers still print the Internet information but there is no easy way of knowing how many people are logging on to read. Concern was expressed that waves, sand, coastal and inlet issues are studied, but there does not appear to be anything in the program to cover silt and clay. There is a need for an Estuary Sediment Program as an estuary is the natural extension of an inlet. It was also recognized that funding cuts have jeopardized the continuation and initiation of new program work units. The Coastal Engineering Manual is being updated with some sections completed, however, full editing of the entire manuscript is required to maintain consistency throughout the document

19. Dr. Jeffery Holland discussed hydro-environmental modeling system development. This development, which is both Civil and Military, involves six laboratories as well as EPA and DOE. Major issues are contamination/clean up, loss of training capabilities/land management, habitat restoration, stewardship of natural and cultural resources and other military issues. There are three major systems (listed below) currently, with a fourth system (LMS listed below) in development. Each is a system with many tools, a suite of models, all in a standard format, that can be used to address several problems. Available tutorials teach 50% of what is needed. The systems involve surface water analysis, 3D and 2D hydrodynamic models, and water quality models for surface and groundwater. They also include models for modeling watersheds, sediment transport, and overland erosion;/deposition. The models can be rapidly set up and the outcome, such as a contaminated plume, can be overlain on maps to quickly visualize the results. Software has been reprogrammed to run on DoD high performance computing machines. Interoperability is needed between models, they need to talk to each other. Note that interoperability is needed between models within these systems so that they can seamlessly link to each other. The use of the Internet has enabled data sharing and empowered a collaborative process using multiple resources to make decisions.

Surface water Modeling System (SMS)
Groundwater Modeling System (GMS)
Watershed Modeling System (WMS)
Land Management Modeling System (LMS)

20. Discussion: The models used in these systems are in the public domain, however, some interfaces are proprietary. All models must be brought in house to examine and test. Input specifications can be found in an on line catalog that identifies every input and its units (http://www.denix.osd.mil/LMS/). The SMS, GMS, and WMS, are available on the CHL homepage (http://chl.wes.army.mil/software/). The LMS is not yet available. The models and manuals can be downloaded by DoD, EPA and DOE. When asked about nesting, Dr. Holland indicated that there are ways it can be done but the process needs to be formalized. Districts can download the models and are asked to help support the effort by paying a numerical model maintenance fee. Some felt it was unfair to have paying districts support non-paying districts.

21. Mr. Joe Letter, described a proposed new work unit, Hydraulic Design of Tidal Wetlands. The objective of the work is to develop tools for designing a variety of control structures for regulating flow into and out of tidal wetlands to control both inundation frequency and salinity levels and to develop inlet channel sizing requirements for tidal wetland establishment. Corps' projects effect wetlands when the areas are used for flood control, navigation and land reclamation. To mitigate harmful project effects, control strategies for wetland management can be developed. Control or modification can be placed on tide range, sediment supply, salinity, vegetation, and topography. This research will attempt to identify the optimum inundation frequency and duration to establish and maintain a healthy wetland using analytical techniques, numerical models and field experiments. Vegetative roughness and wetting and drying algorithms will be improved in the numerical models which will be used to provide diagnostic and prognostic guidance in modeling control structures. He cited several previous tidal wetland studies that will serve as a foundation for the new work. The work will also include design and operation guidance for the proposed control structures.

22. Discussion of design goals. It was stated that it may be difficult to get wetland scientists to identify the design objective. This is needed to establish the criteria the design engineer must design to. Different scenarios and options may have to be presented to assist in defining the problem and an approach to the solution. There are established ranges for wetland types which can be used as a starting point. It might be helpful to ask questions in another way, instead of what do you want, ask what do you want to grow on the wetland? The hydraulic engineer often has a leading role in getting the team to identify and agree on the wetland criteria. There are two approaches to wetland design goals: 1) design the wetland to be a natural wetland without manual intervention or 2) modify the current wetland so it will follow the natural evolution of a wetland, i.e. elevation and inundation and the species will change with the evolution process. Design short term modifications to meet long term goals. It is also important to understand the wetland foundation (sediment) as the starting point in the evolutionary process.

23. Discussion of numerical modeling. The plan is to make enhancements to existing models recognizing that some relatively unknown processes such as the trapping mechanism may be hard to model. The friction coefficient for moving water is used and vegetation roughness information can be found in the literature. Concerning the wetting and drying cycles, the example of the Mississippi River

delta model was cited in that it was easy to validate with the geometry of the natural delta but had problems with man made changes such as dredging. The model modifications will be in the Surface water Modeling System (SMS). This is a useful feature and allows those making decisions to visualize the model output. It was mentioned that the soon to be available Wetlands Engineering publication will include some of this information. The publication is a WES report from the Wetlands Research Program.

24. Dr. McAnally presented, for Mr. Allen Teeter, the draft of a proposed work unit called Innovative Sediment Management Methods. The object of this work is to identify methods and techniques to avoid or delay dredging thus reducing sediment deposition and the associated costs of dredging and disposal operations for fine-grained material in deep draft channels. Lessons learned from successful procedures such as sediment traps, current deflector walls and bendway weirs will be documented and publicized. Using knowledge and understanding of sediment physics, potential methods to reduce sedimentation by trapping and consolidation, altering the turbidity maxima or maintaining sediment in suspension will be explored, developed and where possible tested. Results will be publicized and the use of these techniques promoted.

25. It was brought out in the discussion that success is usually small scale and localized. It was also mentioned that channels should be aligned with the currents for more beneficial results. Reference was made to successful efforts and that the title 'innovative' did not seen appropriate as a literature review produces only techniques that have been previously tried. Work by Wicker, Herrmann, and in the IOMT program discussed the option of channel relocation to reduce dredging costs.

26. Dr. Robert McAdory presented an overview of Tidal Hydraulics Projects. There are four main categories of activities.

a. Numerical Modeling - numerical models to address concerns of wetland flooding, circulation, salinity and sedimentation in estuary and inland environments was reviewed with numerous examples cited. These models are used to simulate the physical processes in the study area and evaluate the effects of proposed changes. Wetland restoration and flood control, ship simulation studies, circulation, velocity, salinity and sediment changes to navigation and the environment are modeled. The visualizations of these changes is especially useful in comprehending the problem and proposed solution.

b. Field Data Collection, Analysis and Instrumentation - Comprehensive field data are necessary for model verification. This activity collects current velocity, water level, salinity, discharge, sediment, weather and wave data for use in the modeling efforts. Along with data collection there exists an expertise in reducing, correcting and presenting the data from the field efforts. Hydraulic Processes Analysis System (HyPAS) is a product of this activity.

c. Laboratory Work - This involves the laboratory analysis of the suspended sediment, waterway bottom sediment, and water samples collected in the field.

d. Dredging Related and Other - Dredging expertise to assist in dredging

claims and sea turtle problems is available as well as assistance with hurricane relief efforts.

27. A question was asked about how the erosion and deposition of different size sediment was handled in the models. Dr. McAdory responded that the model was run separately for each grain size and settling velocity and then the results were combined. Referring to a model display of MOTSU elevation, it was asked if the recommended changes from previous studies made any difference? Dr. McAdory indicated the changes were minimal and that not all the Corps recommendations were implemented. He also stated the SMS (Surface water Modeling System) used is the graphical user environment formerly known as TABS and FastTABS models.

28. Mr. Robert Athow discussed the South Florida Restoration Project Modeling. The issue being addressed is the effect of water distribution on environmental quality in South Florida. CHL is supplying hydrodynamic and salinity information to drive the water quality model. The fresh water in the area is being lost to diversion, consumption, agriculture and transpiration. FEMWATER, a ground water model is used where the interaction between surface and groundwater requires the use of diffusive wave modeling. The project area is divided into two models. The Everglades National Park (ENP) model is well verified. It does not include Lake Okeechobee. The South Dade model contains the rest of the study area. The models have gotten too big to be run on a workstation so parallel processing is used. Some re-coding was necessary, however, this enables big models and long time frames to be run on these machines. There was difficulty in obtaining adequate gage and sample data from such a large area. Information on ground water, surface water, recharge and rainfall is needed. He also stated that the South Florida aquifers dip to the east.

29. Discussion questions were answered by Mr. Athow, Ms Donnell and Dr. McAdory. There was doubt that the project sponsor would be able to run such a complicated model and it was suggested that the sponsor be encouraged to ask the questions and CHL run the model to supply the options and answers. In response to several questions about storm surge and the use of separate models, Ms Donnell indicated that the model does not include storm surges and coastal storms. She also indicated that the models are too big to be run together. The criteria given is that the model be able to run on a workstation in a given time frame. The technology is not yet available to accommodate the two models on one workstation. It was reasonable to divide the project into the two sections as it took advantage of a natural divide in the study area. The models take into account the total water distribution system and does not eliminate the canals in the area. Now that it is possible to connect groundwater and surface water models, it needs to be demonstrated that an adequate job of modeling can be done. There is some cost to convert the code for high performance machines but once done, it is simple and much faster to run. Legacy systems may need the code conversion but all new programs will be able to use these machines.

30. Dr. Trimbak Parchure discussed the Panama Canal Salinity Intrusion study. The canal has been in operation since 1914 and since then ship size and traffic volume have increased. This has resulted in limits placed on vessels using the canal. The goal of the study is to increase the capacity of the canal without

introducing excess salinity. Fresh water flow into the two lakes is controlled and in normal times everything is okay. Drought conditions with less freshwater poses questions of the environmental effect of increased salinity in the system. Some options under investigation are: Syncrolift, a shiplift and transfer system; bubble screens; flap; a long and deep channel; and a holding pond to recirculate water. The canal is 50 miles long with an 85 foot lift. The holding pond concept would conserve fresh water and prevent salinity intrusion into the canal system. Model runs of several scenarios for holding ponds and lake water operations have been run giving qualitative salinity results. The Syncrolift system and how it works was described to the Committee. It is an elevator-type platform or box that lifts ships from the water and transports the platform with ship (or box with water and floating ship) vertically. In the case of the canal it would be from sea level to the lake.

31. Discussion: Regarding the Syncrolift system, the Committee suggested that the velocity patterns in the lift box and the flow pattern of the entrance water be examined. Since the ship lift was not yet designed, it was difficult to estimate if this system would break down or malfunction more often than any of the other options. All options under consideration would be used to supplement rather than replace the current canal system. When questioned about the effectiveness of the bubble barrier, Dr. Parchure indicated that they were not very effective. Previous tests using bubble barriers show that the barriers are not effective if there is some water column mixing. A Scripps study found the bubble barriers were good for keeping floating debris away from areas where it is unwanted. The caution was raised that the existing dam is a hydraulic fill structure located in an earthquake zone. Be very cautious if more dams are to be built in order to increase storage capacity of fresh water.

32. Mr. Michael Alexander reviewed the plans for a 3 year study of the shoaling problems at the Military Ocean Terminal at Sunny Point NC. (MOTSU). MOTSU has experienced rapid and excessive channel shoaling because of its location in the Cape Fear River at a turbidity maximum zone. The object of the study is to develop plans or techniques that can be used to reduce the maintenance dredging requirements and costs for this area. The plan is to model the bathymetry, currents, tides, salinity and sediment concentrations of the area using TABS-MDS (CHL's version of RMA-10, including sediment transport). The model would then be used to evaluate the effectiveness of different shoaling reduction plans.

33. Discussion: It is important to include sediment density in the model, in order to be able to simulate fluid mud which is present in the MOTSU channels. When asked if there are any dams that might have effected or changed the flows, the reply was that no changes have been made although there is talk of removing the dam. There appears to be two options, either keep the sediment out or, once in, move the sediment out. This can be done by increasing the current speed, however as the sediment density increases for example from 1.2 to 1.25, more energy is required to remove the material. Care must be taken to be sure any increase in velocity does not create a safety problem for the commercial navigation in the Federal channel. A suggestion was made that the closure of Snows Cut might help. Snows Cut, located north of MOTSU, connects the

Cape Fear River with the Atlantic Ocean. It is part of the AIWW and its closure would not be popular.

34. The Committee requested additional MOTSU information. Mr. Alexander, Mr. Trawle, Dr. Berger and Dr. McAdory met with the Committee at a later time for further discussion. A summary of the discussion follows. The shallow areas between MOTSU and the main channel are not diked. They are shallow areas with water flowing over them. Only the small dredge material island is always above water. It is a military requirement that there be 3 channels (or at least 2) so the facility can be rapidly evacuated in an emergency. The facility handles explosive material and in case of an explosion rapid evacuation is essential. The facility must always be in a state of readiness even if it is not actively used a great deal. There is a safety issue here in that a dead end loading operation is not allowed. A buffer zone is needed between MOTSU and the main navigation channel even though there is relatively little commercial traffic in the channel. The sediment source is mostly from the river although some is the result of the null zone. Salinity varies with flow. The tide range is 4-6 feet. Silt enters the area as suspended material, slows as it passes over the shallows and stays in the channel as fluff or fluid mud. Sheet pile wharfs were constructed to keep the sediment from storing under the wharfs and moving out into the channel. There may be enough prototype data to set up a model to look at the shoals, make some changes and see how the system reacts. There may be 3 permanent tide gages in the area. Snow's Cut is an artificial cut with high velocity in both directions. The cut is 15 feet deep and 100-200 feet wide. It is a part of the inland waterway system.

35. Dr. Joseph Gailani presented information on the Providence River Dredging Project. The project involves the dredging of over 4 million cubic yards of fine-grained, cohesive (mostly clay with silt) material, some of it is contaminated and requiring EPA site approval. Disposal options include open ocean placement of the uncontaminated material and confined aquatic disposal (CAD) facility placement of the contaminated material. To address the concerns of EPA and the state, a scope of work was developed that included field measurements, laboratory sediment analysis and a suite of models designed to predict the effects of dredging, disposal and long-term stability of the disposal sites. It is anticipated that this study would develop sufficient information for an Environmental Impact Statement that will permit EPA site designation. The framework developed for this study could also be used at other locations requiring EPA site designation. The material to be dredged has a very low bulk density, it is very much like pudding. It did not consolidate after a 15 year simulation in a centrifuge. Preliminary tests indicate there is no organic content and lead appears to be the main contaminant.

The models used in the study are:

a. DREDGE - plume created during the dredging operation.
b. STFATE - estimates plume concentrations created and apron of deposition during a single dredges material disposal.
c. MDFATE - multiple disposal version of STFATE for predicting mound configuration and area effected by sediment deposition.

d. ADCIRC - models tidal and storm-induced currents. This data set included the 1938 hurricane.

e. LTFATE - modeling of mound stability and dispersion of dredging material during storm and non-storm conditions.

f. EST - Empirical Statistical Technique, simulation of depth of erosion frequency.

g. SURGE/STFATE - modeling of CAD pit disposal losses.

36. The discussion centered on the pudding-like quality of the material. The area is shallow with the potential that people might walk on it especially at low tide or that the softness of it would not be able to hold a heavy cap. If the uncontaminated soft material is to be used for the 2 foot cap, there was great concern that a person could sink up to the waist or deeper in this pudding-like sediment. This is an urban area and safety must be paramount. It was also disclosed that the upstream area may become a superfund site.

37. Dr. Charlie Berger offered a proposal for Descriptions of 3D Numerical Models. The proposal suggests a means by which engineers and scientists could more easily understand the capabilities and limitations of numerical models. This understanding would enable them to make better informed decisions about model selection for their projects. Numerical models are a discrete representation of a set of differential equations that propose to represent nature. Since computer codes are developed on a few common themes, a summary table of standard model features and a description of the most commonly used 3D hydrodynamic models (e.g., TABS-MDS, CH3D-WES, MIKE3) is proposed. The principle factors to be described are:

a. Implicit/Explicit - this will effect the time step and model stability. Implicit method solves many unknowns and requires more time per step. It is suited for steady-state or slowly changing phenomena. Explicit method solves one unknown and therefore is faster per time step. This method is suited for a short-lived phenomena. The summary would include the type of solver used.

b. Grid Topology - this relates to the mesh being structured or unstructured. A structured approach may require more resolution to reproduce a complex geometry while an unstructured mesh can more easily handle complex geometry, placing the resolution where it is needed.

c. Stabilization - refers to the advection term representation.

d. Linearization - Identification of the scheme used, i.e., Newton methods, or predictor-corrector methods. This influences the size of the time step that can be used accurately.

e. Other model descriptors such as vertical transforms, equation set and equation assumptions should also be identified,

38. Discussion summary. At the last CTH meeting in New York, a District contractor chose to use MIKE3 because it was easier for them to use and had features they needed. The suite of MIKE models enables easy movement from one model to another in the suite. Two different models were used for the one

project, the engineering study used WES models and the environmental study used MIKE3. As long as the same equations are used there should be no significant difference.

39. There was great support for the development of a summary table of models similar to the sample supplied by Dr. Berger. It was suggested that something about model accuracy be included in the summary. If the resolution is increased it will reduce the error, however it may also affect the cost. Grid refinement tests should be run to determine the sufficient amount of resolution needed. Other suggestions were to include examples of good applications of the model as well as cautions to be on the lookout for. When asked if all these models were equal in handling wetting and drying routines, Dr. Berger indicated they were not. Mr. Allen Teeter has had success with TABS-MDS by using both marsh porosity and wetting and drying.