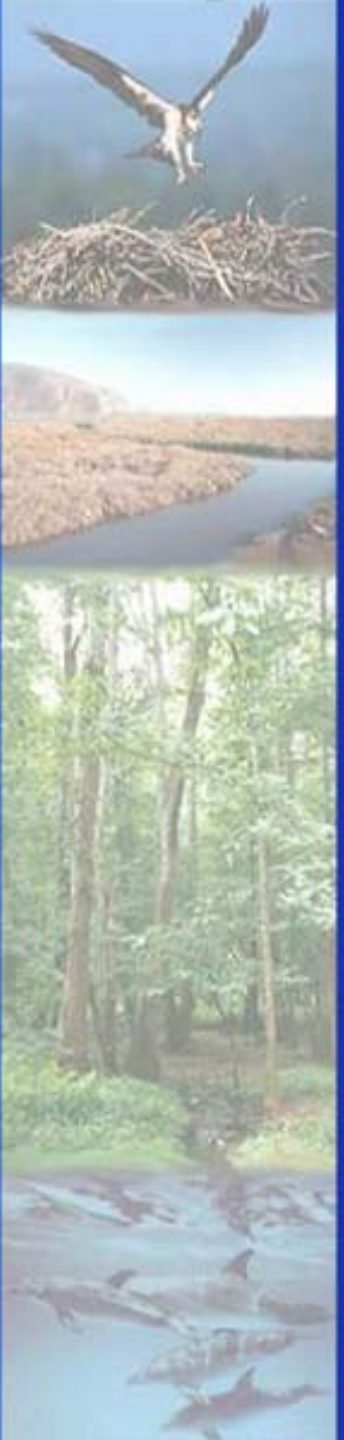


Navy Cost-to-Complete System Verification, Validation, Accreditation

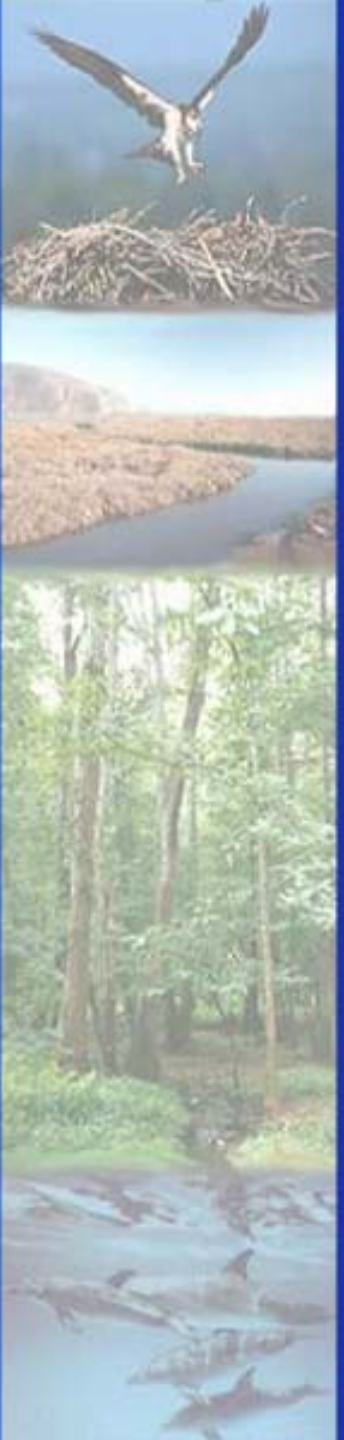
VVA Technical Working Group

Army and Navy Joint Workshop

Naval Facilities Engineering Command

15 November 2001

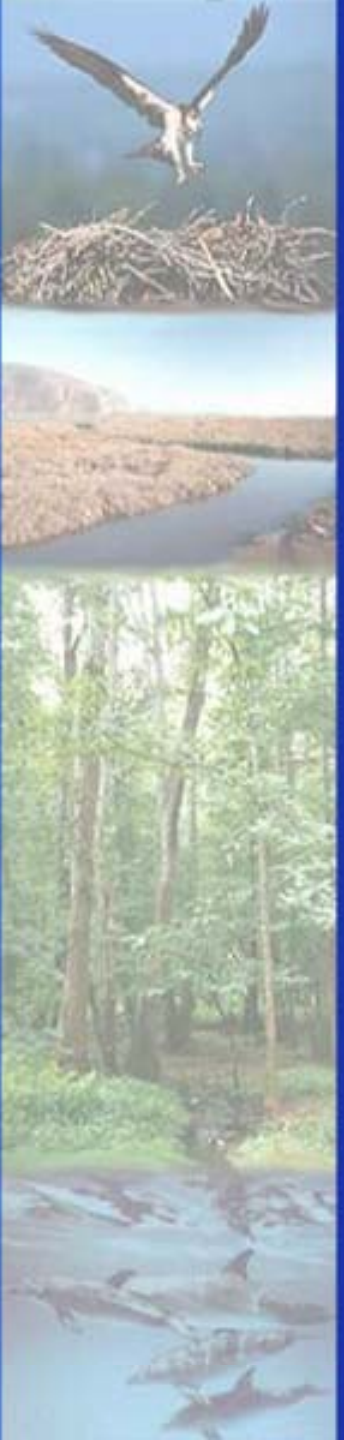
NAVFAC



Overview

- Background
- Why Accredit
- Key Personnel
- Accreditation Process
  - Problem definition
  - VVA Planning
  - V&V efforts
  - Accreditation
- Lessons Learned
- Questions

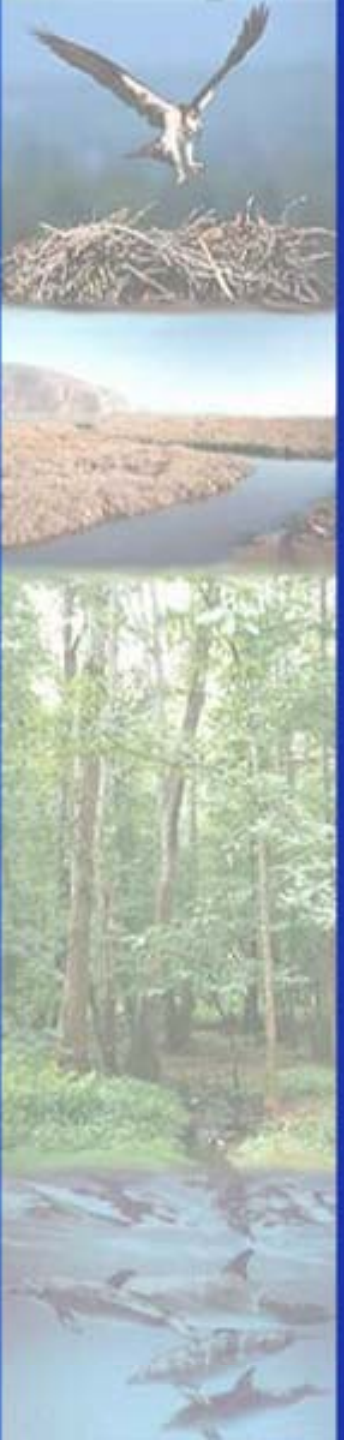
NAVFAC



Background - Program

- Navy Environmental Restoration
  - 4700 sites
  - Estimated cost-to-complete of $ 4.5 Billion
- Challenges
  - Provide credible estimate for individual sites from study to cleanup to support programming, planning, and budgeting
  - Dynamic requirements through closure

NAVFAC



Background
Parametric Estimating

- Top-down approach
- Minimum need for specific information
- Efficient
- Ideal for budgeting

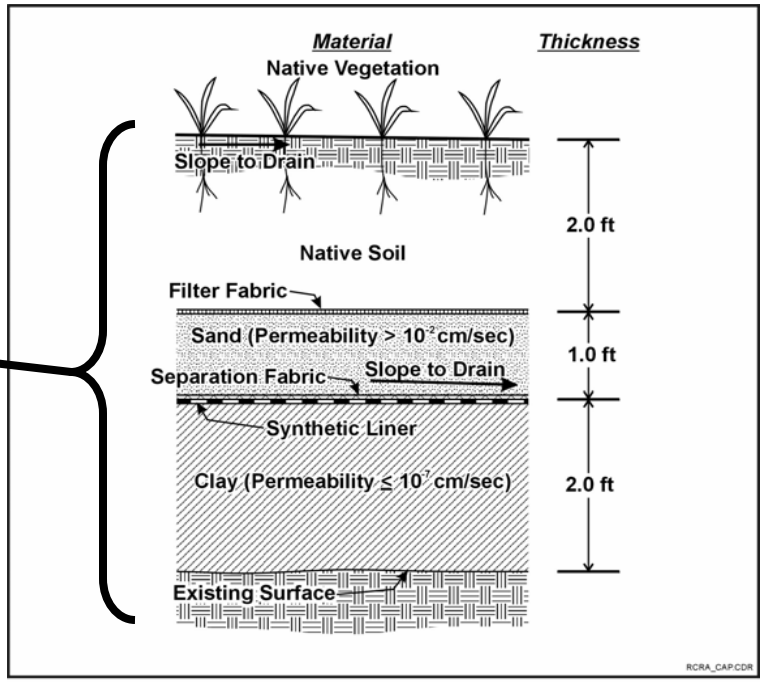
- Considered a model requiring Accreditation
  - Integrated intelligence

NAVFAC

Parametric Cost Models

- Analyze Technology
- Identify Components and Determine Associated Cost Driving Parameters
- Establish **Cost Estimating Relationships** (CER)
- Verify CERs and Build Cost Models

(Cost Models Integrate Several CERs)



RCRA Subtitle C Cap

Required Parameters

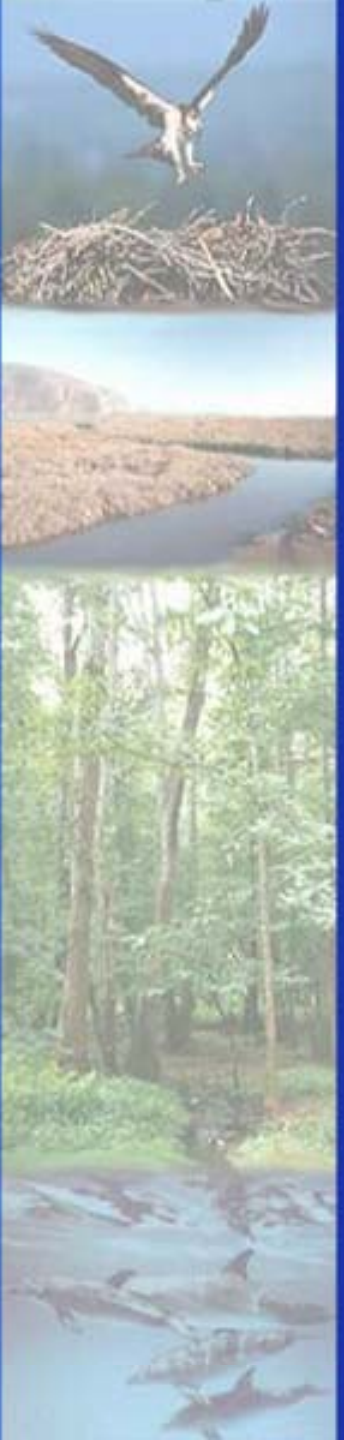
Area of Cap
Operation and Maintenance Duration
Long-Term Management (LTM) Duration
Protection Level

Secondary Parameters

Final Cover
Compacted Clay Liner
Synthetic Flexible Impervious Liner
Liner Material
Passive Vent System
Thickness Gravel Layer
Asphalt Thickness
Thickness Soil Layer
Thickness of Clay Layer
Source of Fill Material
Source of Clay
Source of Topsoil

CER = f (Required Parameters; Secondary Parameters)

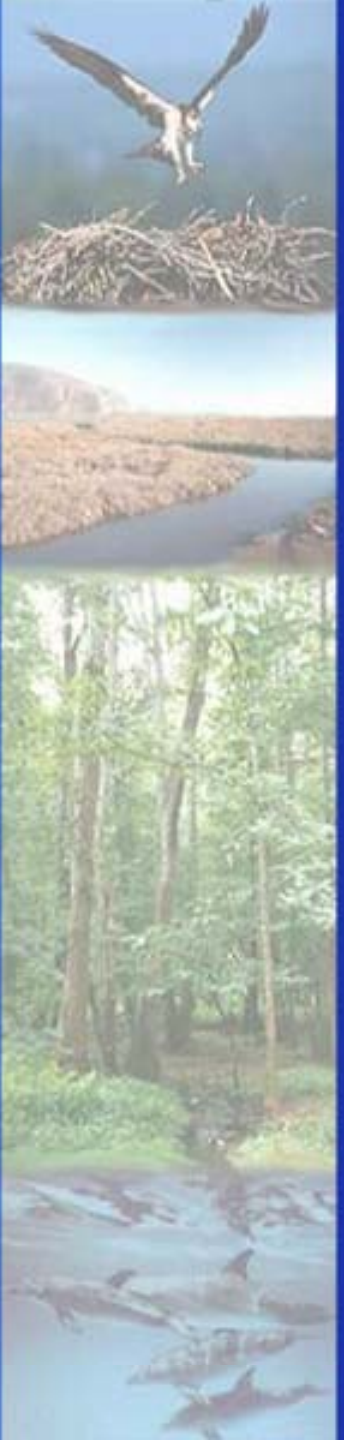
(_Top_Thck/36* _P_Area*43560/9*1.1* IF(_Top_Source='ON',1.74,4.04)+ (_Soil_Thck+6)/36 *_P_Area*43560/9*1.1* IF(_Fill_Source='ON',1.85,1)+ IF(_FLM='Y',IF(_FLM_Type='40H',0.89, IF(_FLM_Type='60H',1.31, IF(_FLM_Type='80H',1.61, IF(_FLM_Type='30P',0.74,0.88)))) *_P_Area*43560*1.13,0)+ IF(_Clay_Liner='Y', IF(_Clay_Source='ON',5.8,5.17) …….



Why Accredit

- DoD IG Report 99-209,"Supplementary Management Guidance for the Defense Environmental Restoration Program" issued by the Deputy Under Secretary of Defense (Environmental Security) in August 1999, and the Naval Audit Final Report N2001-0011 found that CTC did not conform to DoD Instruction 5000.61 – DoD Modeling and Simulation Verification, Validation, and Accreditation".

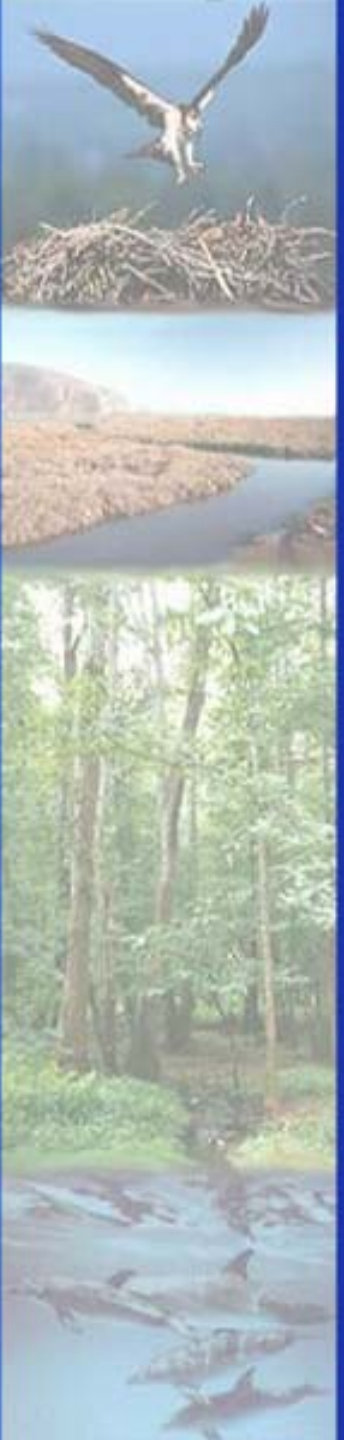
NAVFAC



Why Accredit

- Initially positioned that requirements of the DOD Directive 5000.59 and DOD Instruction 5000.61, which were originally developed primarily for the use of models and simulations in weapons systems, were not applicable to the CTC environmental cost estimation system

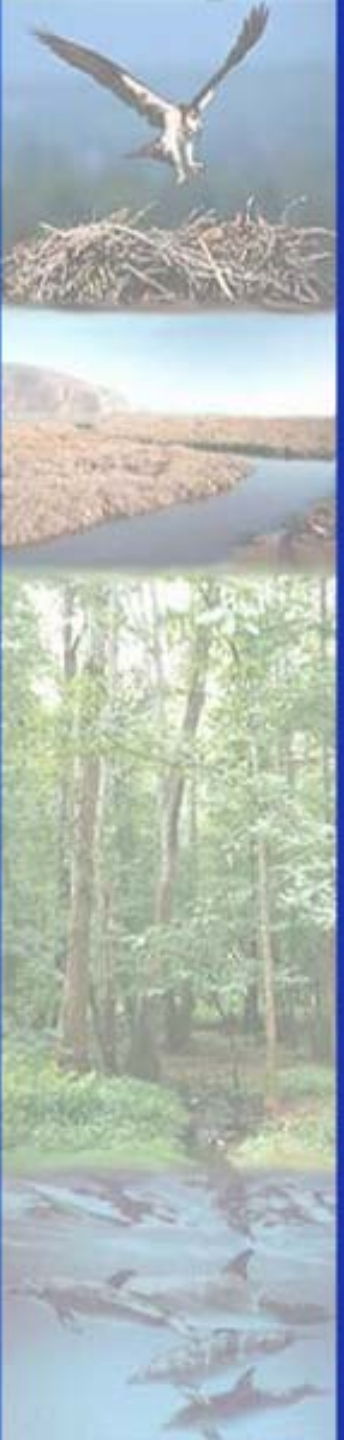
NAVFAC



Why Accredit

- DoD Instruction 5000.61 requires that (models and simulations) M&S used to support the major DoD decision making organizations and processes… (DoD Planning, Programming, and Budgeting System) shall be accredited for that use…
- SECNAVINST 5200.40 requires accreditation.

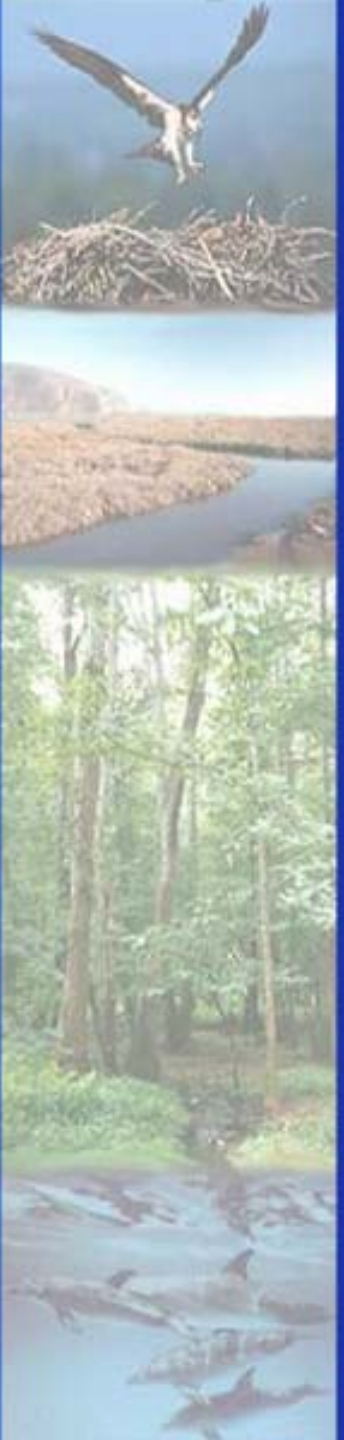
NAVFAC



Why Accredit

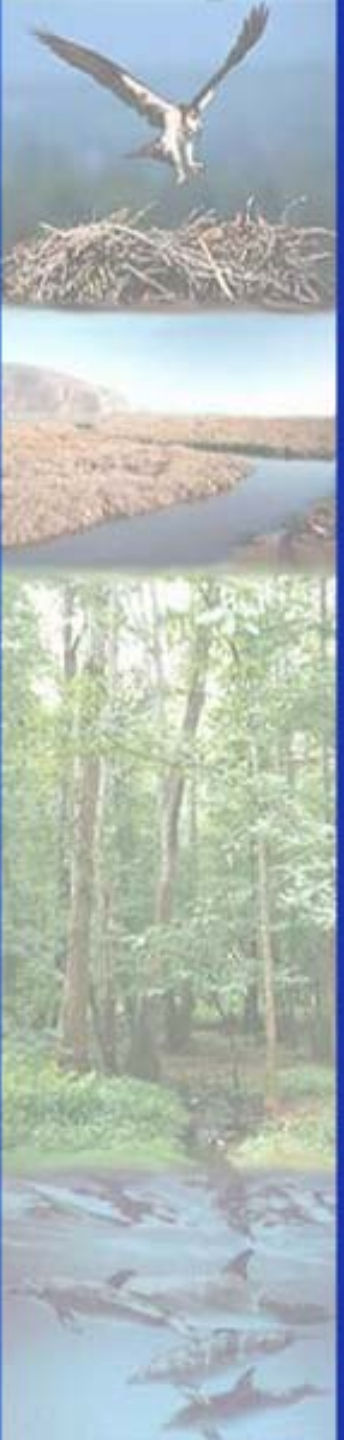
- Increases credibility in the M&S outputs and reduces the risk of using the M&S. Overall this increases the confidence level of decisions made based on the outputs.

NAVFAC



Key Personnel

- NAVFAC
  - M&S Proponent,
- NFESC
  - M&S Proponent Technical Support, M&S User
- SMEI, Battelle, Team Analysis
  - M&S Developers
- PricewaterhouseCoopers, Tesseract
  - Accreditation Agent, Quality Assurance, V&V Agent
- NAVMSMO
  - Accreditation Support

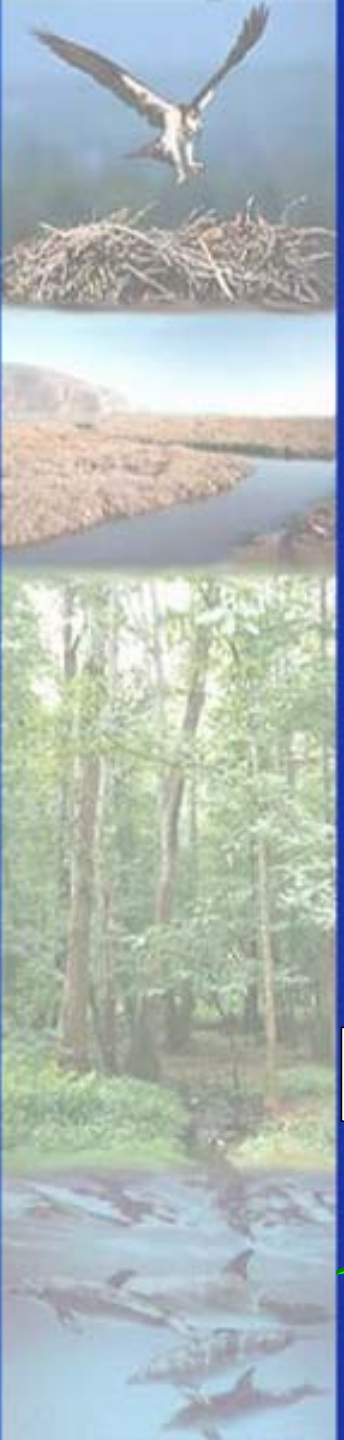


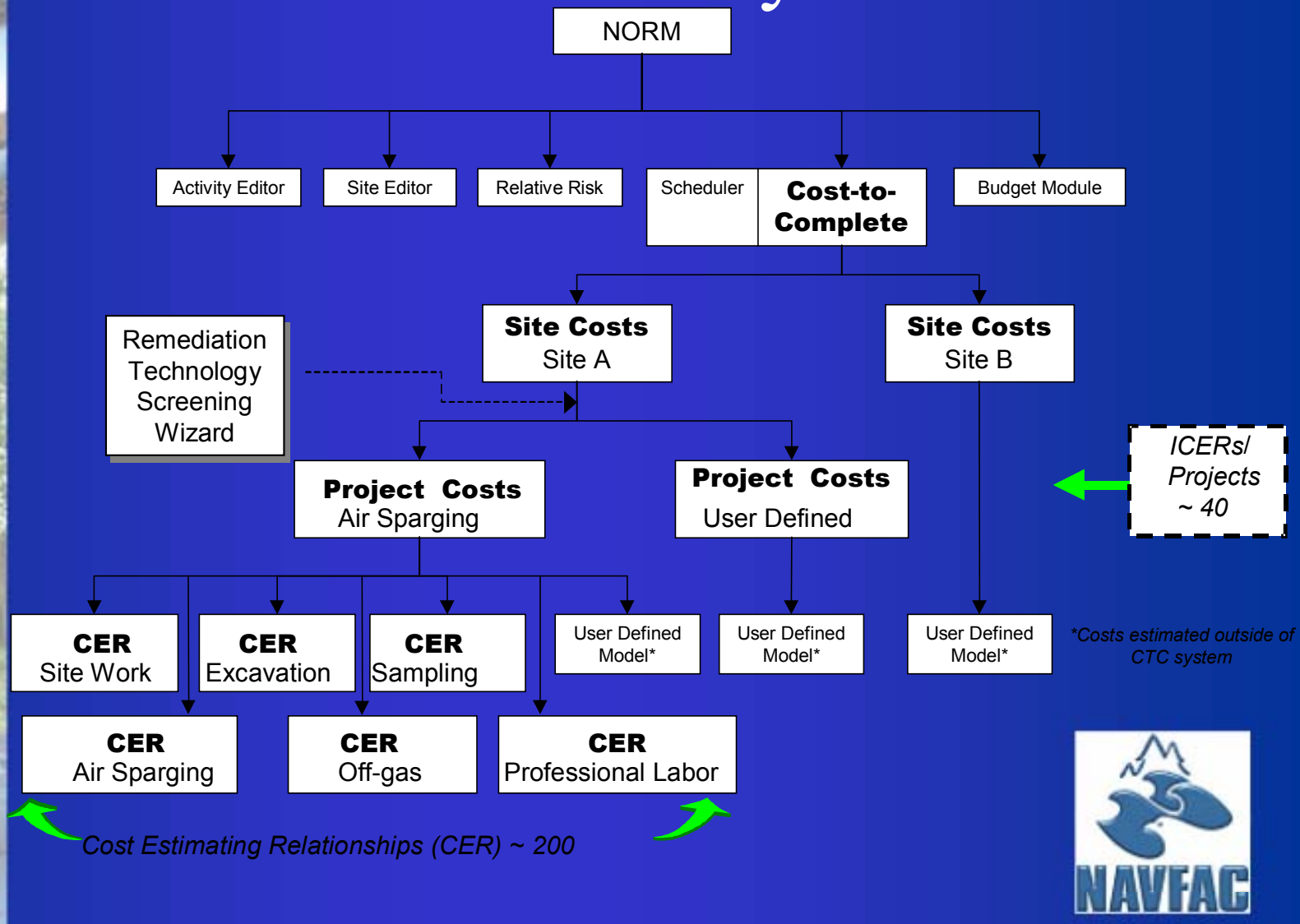
VVA Preparation
Problem Definition

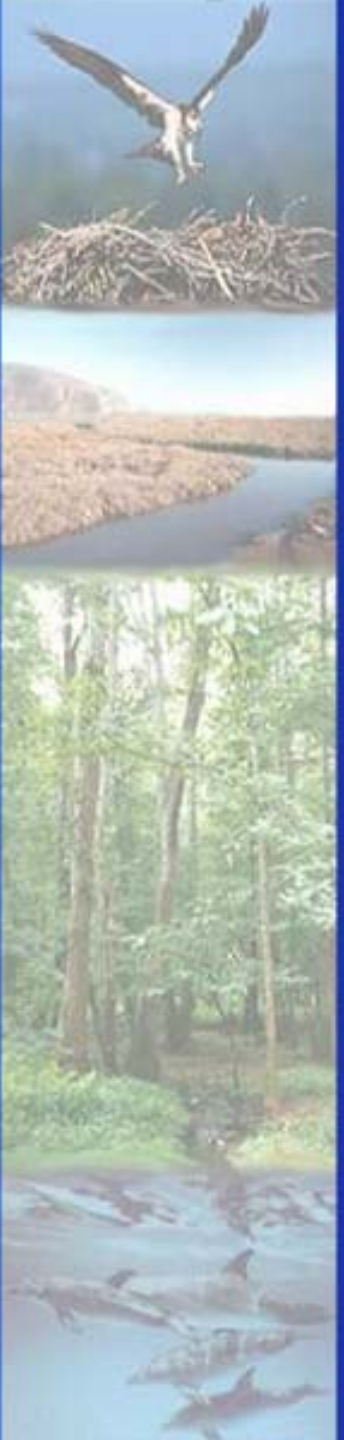
- Define the System
- Understand system and user requirements
- State the Problem

NAVFAC

VVA Preparation
Define the System



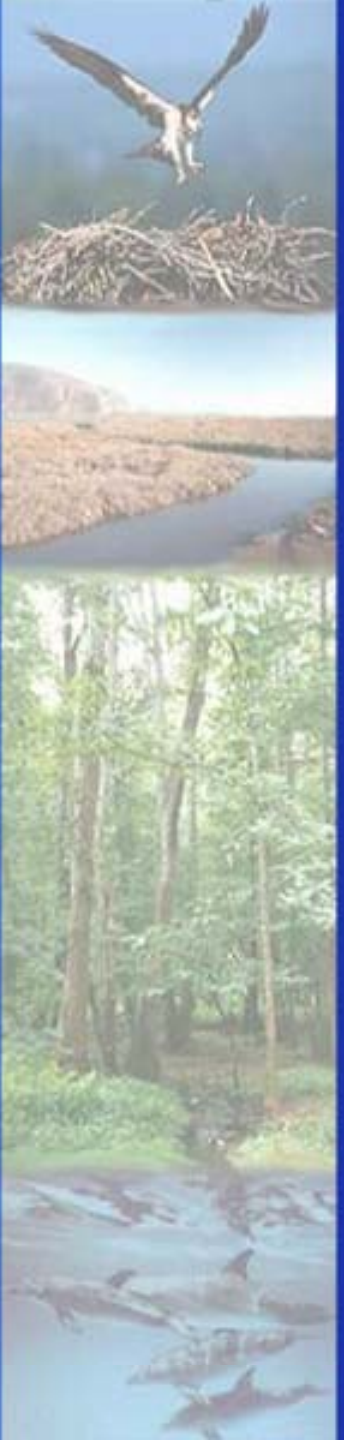




VVA Preparation
State the Problem

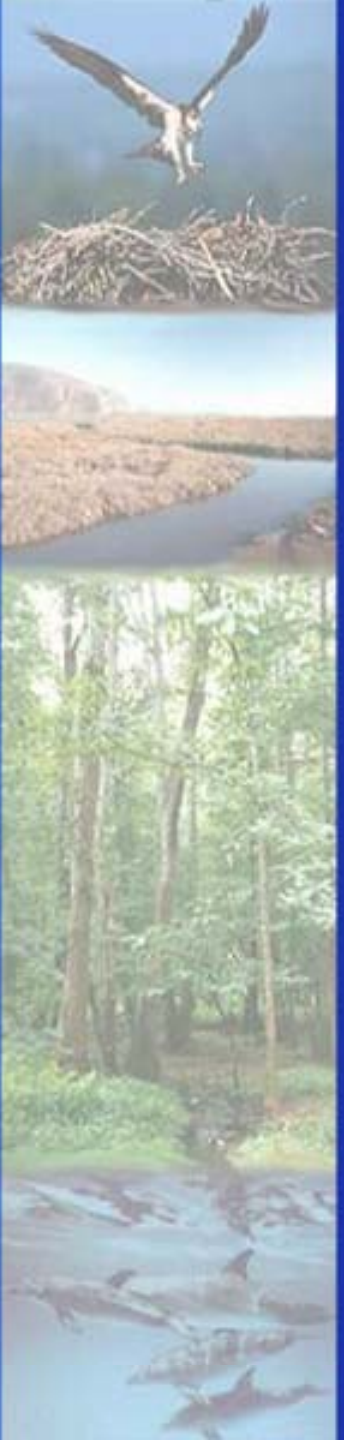
- Understand Requirements
- State the Problem
  - To provide a planning, programming, and budgeting system that supports the estimation and development of credible budgetary requirements and financial statement liabilities for the Navy's environmental restoration program.

NAVFAC



VVA Planning

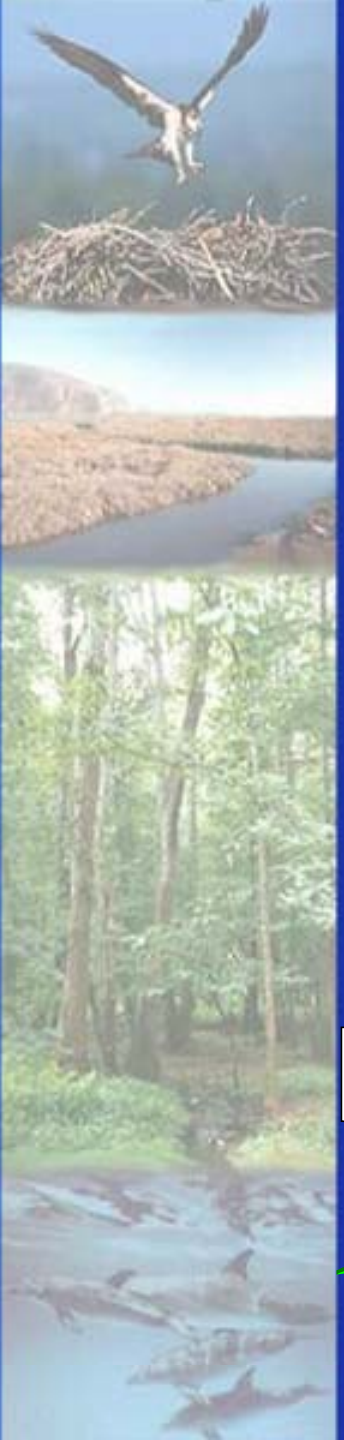
- Define Risk
- Determine Acceptability Criteria
- Plan Accreditation
  - Approach
  - V&V plan

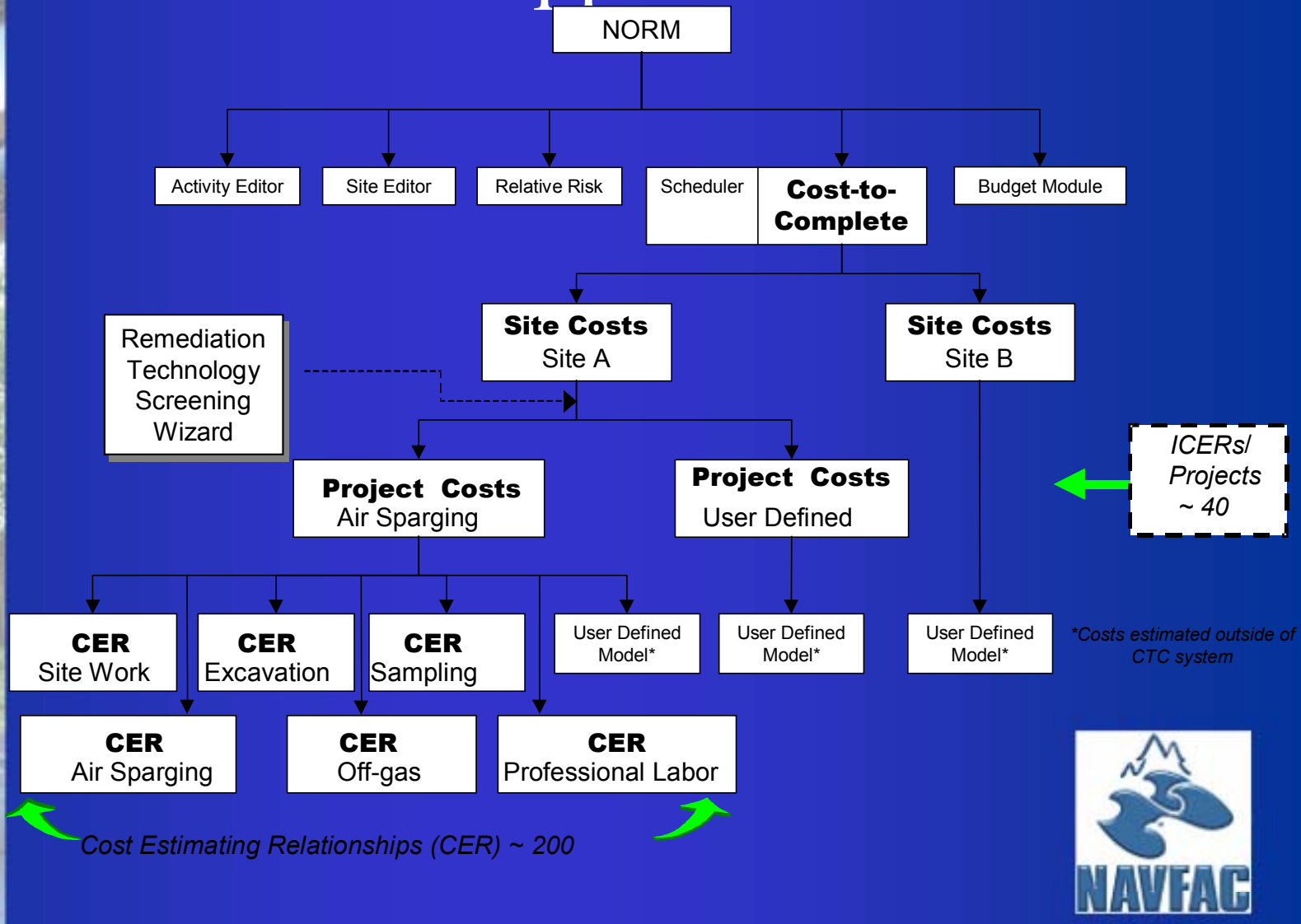


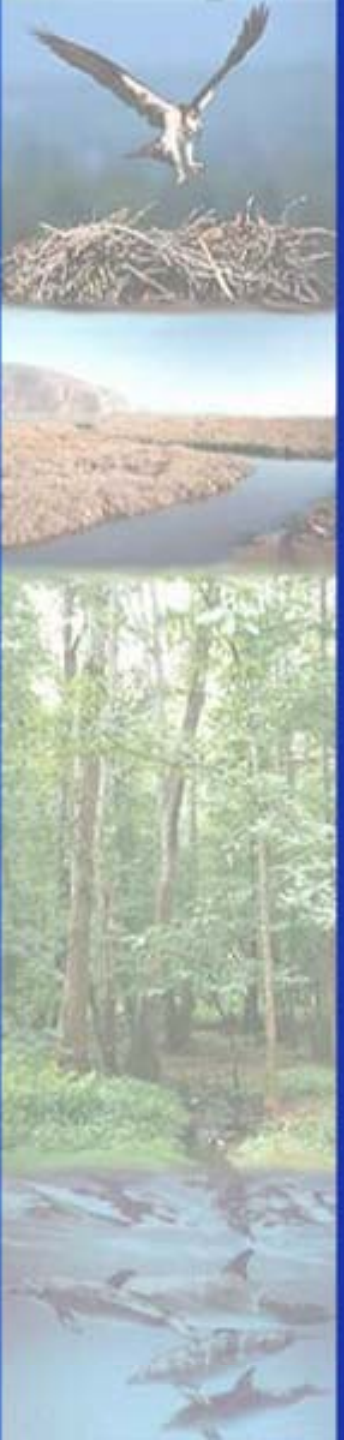
VVA Planning
Define Risk

- Risk drives the level of VVA required:
- Overall Risk of the system was determined to be: LOW
- This risk level meant that the VVA requirement was: NOMINAL

VVA Planning Approach



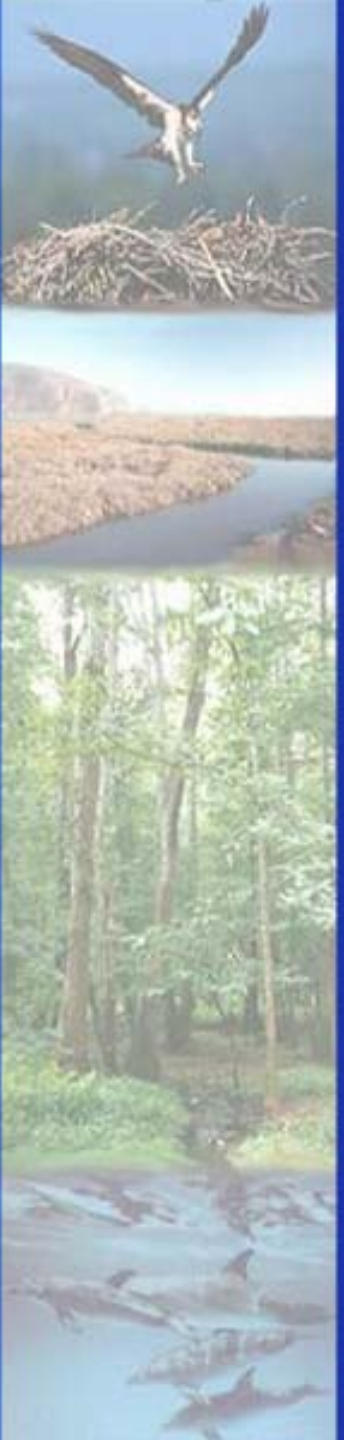




VVA Planning
Develop Acceptability Criteria

- Two key considerations
  - User requirements of the system
  - How to define those requirements in a testable/measurable way
- Acceptability criteria and V&V approach go hand in hand
  - Can't develop criteria without knowing how to test
  - Can't test without knowing what to test

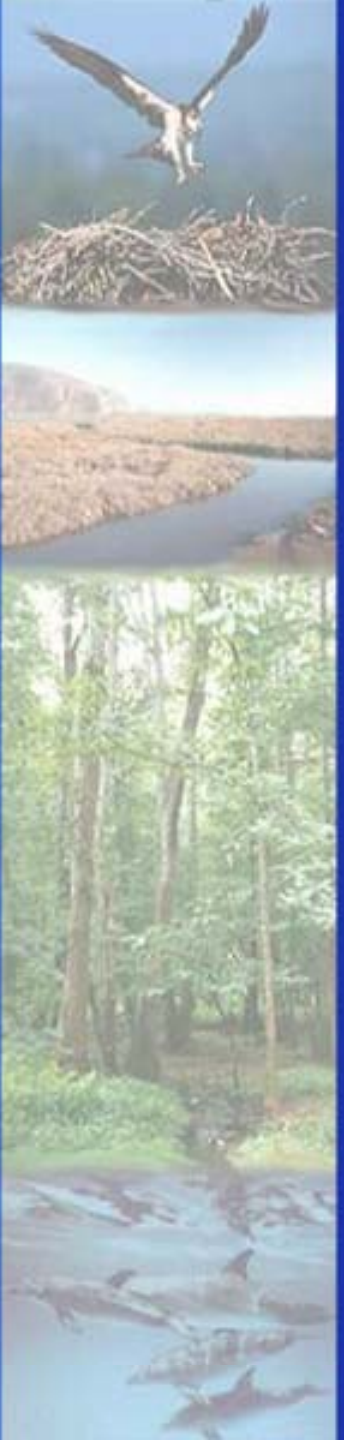
NAVFAC



VVA Planning
V & V

- Legacy System
- Past V&V probably not enough to fulfill DoD and Navy Instructions
- Additional V&V necessary

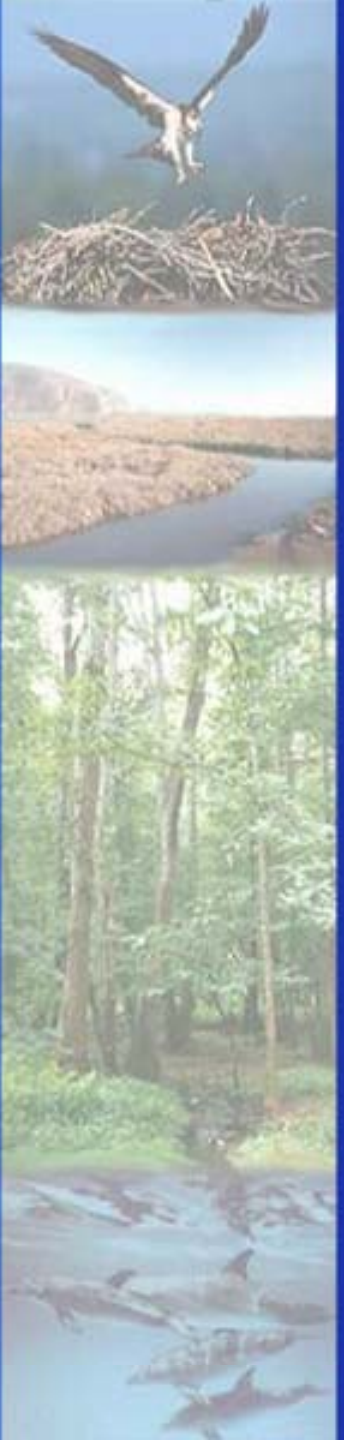
NAVFAC



VVA Planning
V & V

- Verification
  - The process of determining that a model implementation accurately represents the developer's conceptual description and specifications.
  - System and Functional Testing
- Validation
  - The process of determining the degree to which a model is an accurate representation of the real-world from the perspective of the intended uses of the model.
  - Face-Value Validation

NAVFAC

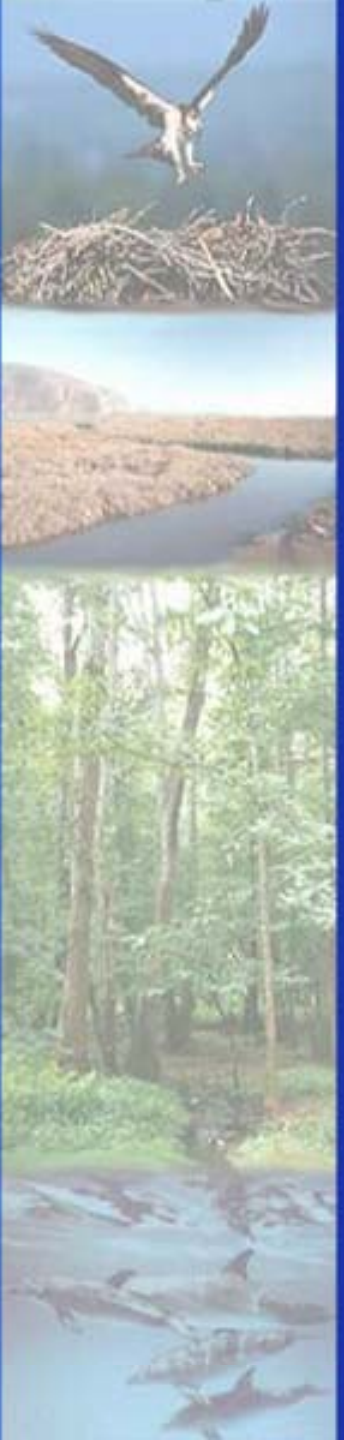


Acceptability Criteria

➢ Model Fidelity and Performance

- Cost Estimating Relationship (CER), Integrated Cost Estimating Relationship (ICER), and Technology Screening Wizard modeling logic and design are based on standard cost engineering practices and reflect the professional judgment of subject matter experts.
- CER, ICER, and Technology Screening Wizard modeling output, and required input is consistent with the professional judgment of subject matter experts, and trained and experienced remediation managers and cost estimators.
- CER, ICER, and Technology Screening Wizard modeling input that is required is consistent with the level of project and site information that is generally available at the time budgetary estimates are prepared.
- CER, ICER, and Technology Screening Wizard modeling output, at a minimum, provides a level of detail that is appropriate for budgetary estimates.

NAVFAC

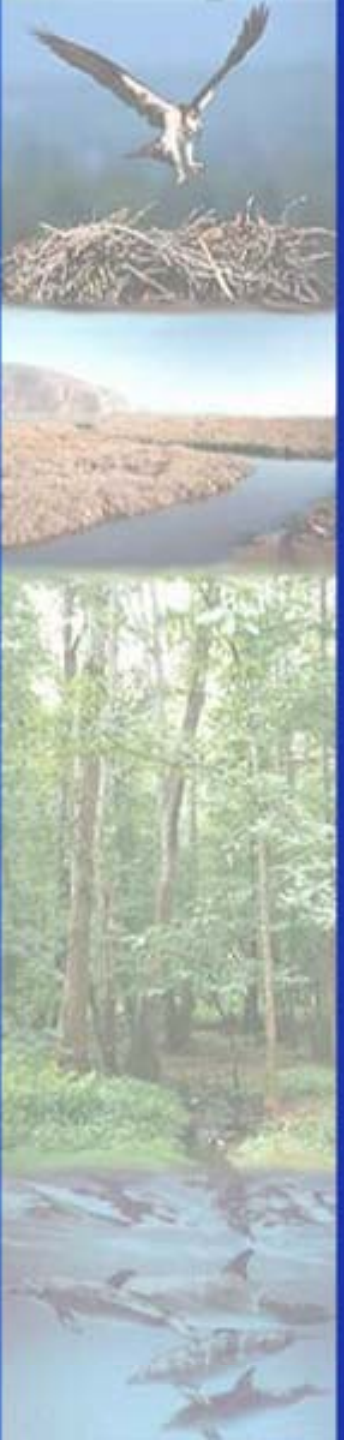


Acceptability Criteria

➢System Integration and Performance

- CER, ICER, and Technology Screening Wizard modeling components are effectively integrated with each other, and within the entire CTC system.
- The CTC system provides for the flexibility to input cost information generated outside of the system using other engineering estimating means and tools. These externally generated costs can range from a line item or assembly item detail that enhances the accuracy and completeness of an individual CER, to a detailed independent Government estimate that serves as the total project or site cost-to-complete.
- CTC system integrates effectively with the overall NORM system by receiving the necessary input from the NORM system and providing the appropriate output.
- The CTC system provides the functionality to roll-up all costs to the individual project and site levels.

NAVFAC

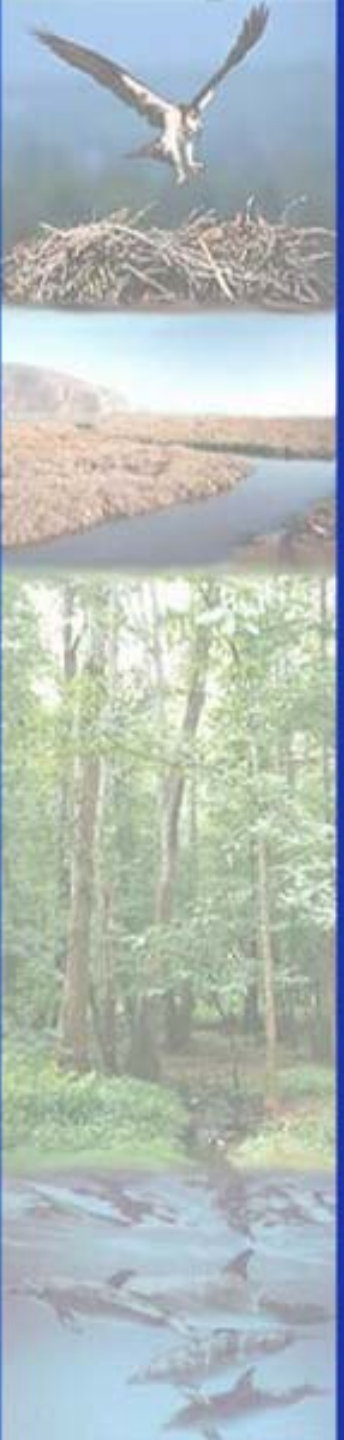


Acceptability Criteria

➢ System Integration and Performance (Con't)

- The CTC system provides the functionality to roll-up costs to the Scheduler component phasing levels so that costs can be aligned with the schedule for budget development.
- The CTC system allows for the use of "package level" parameters such as area cost and escalation factors that can be applied at a "high level" per site.
- There is a capability to print out a record of each cost estimate including a narrative with sufficient explanation for the basis of the estimate, the date prepared, and the estimator's name in each CTC Site-level estimate. The CTC system can produce an audit trail sufficient to trace a liability from source documentation to NORM.

NAVFAC



Acceptability Criteria

➢Configuration Management

- The Configuration Management of the CTC is sufficient to produce controlled and repeatable cost estimates.
- The Configuration Management policy is in effect and responsive to the anticipated needs of the M&S users.

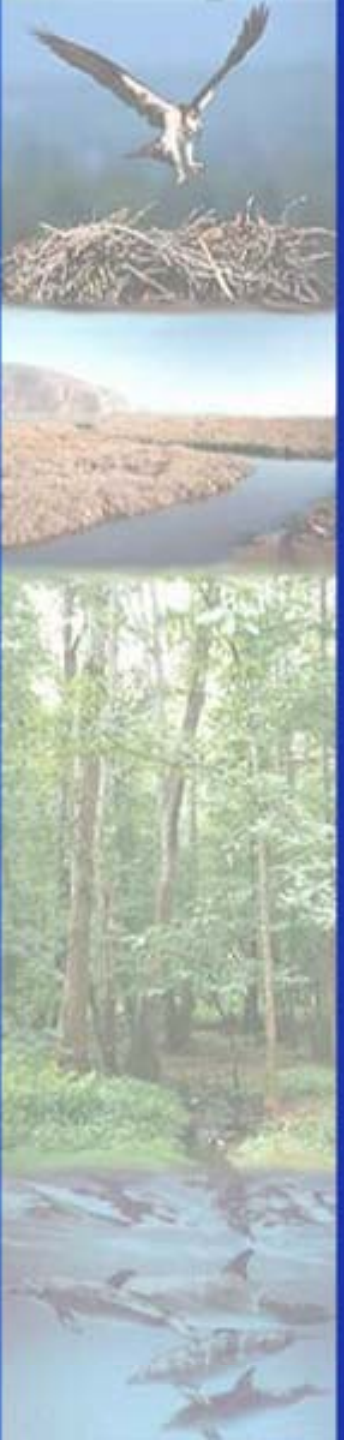
➢Policy

- The CTC accreditation process satisfies the intent of regulatory guidance found in DoDI 5000.61, and SECNAVINST 5200.40.

➢System Documentation

- There is sufficient documentation demonstrating good system management and business practice to support the credibility of CTC.
- The software user's manual, user training, and user help are adequate.

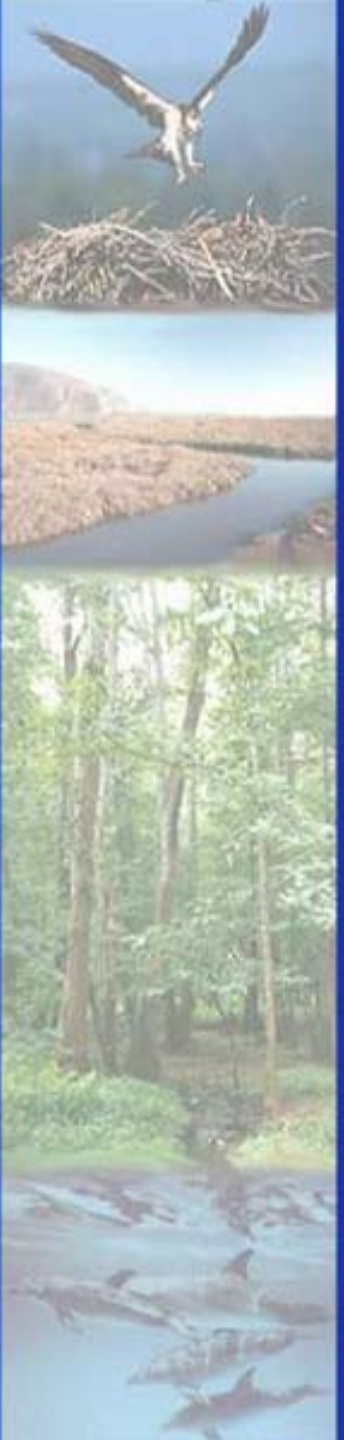
NAVFAC



Acceptability Criteria

- "Navy's ERP" System Requirements
  - Simple client-side configuration scheme
  - Central data collection
  - Real-time access
  - CTC system integrates effectively with the overall NORM system by receiving the necessary input from the NORM system and providing the appropriate output.
  - Address a geographically distributed user community
  - Low maintenance cost models

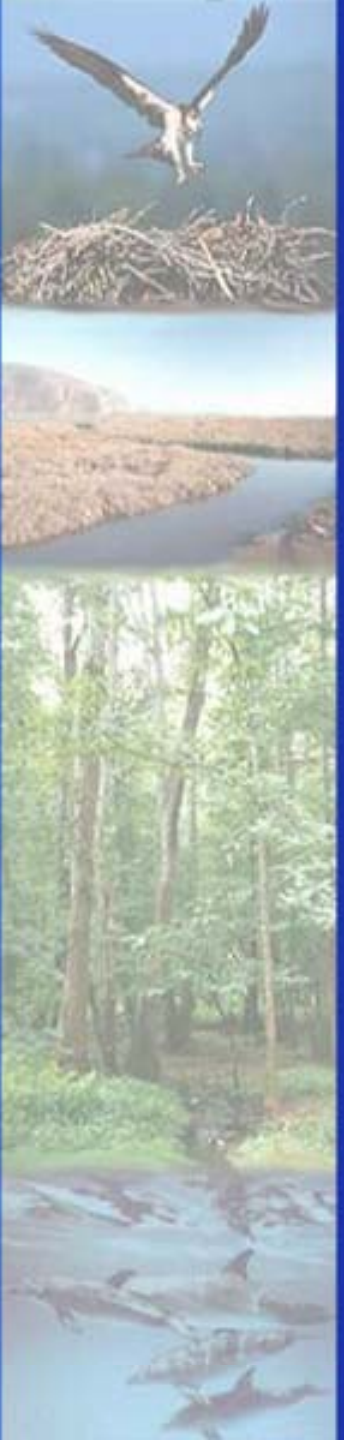
NAVFAC



Assumptions and Limitations

- The level of information available for the estimate.
  - Do we have detailed drawings or is the estimate based on a conceptual design?
- Professional knowledge, skills and experience of the estimator.
  - Do we cap or excavate?

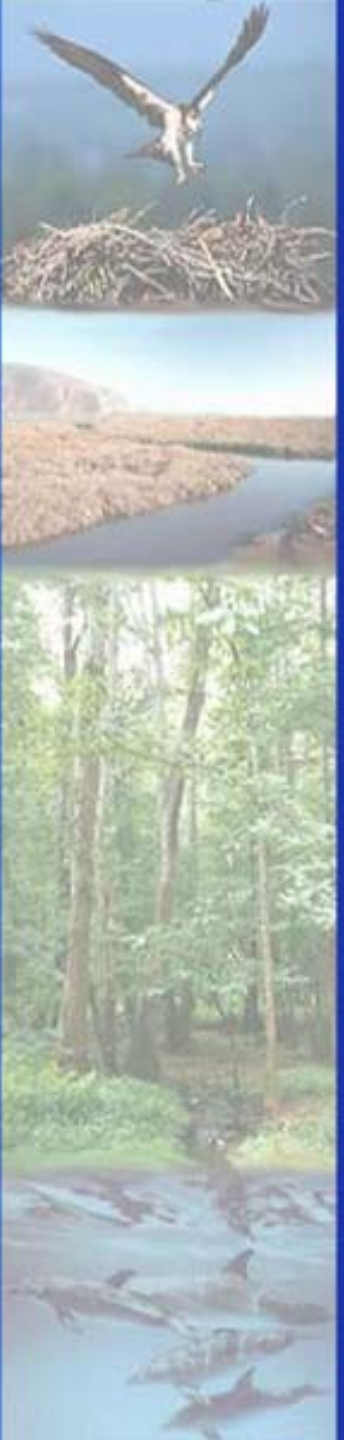
NAVFAC



V & V Efforts

- Verification
  - System and Functional Testing
  - Tested all models
- Validation
  - Face-Value Validation
  - Subject Matter Experts

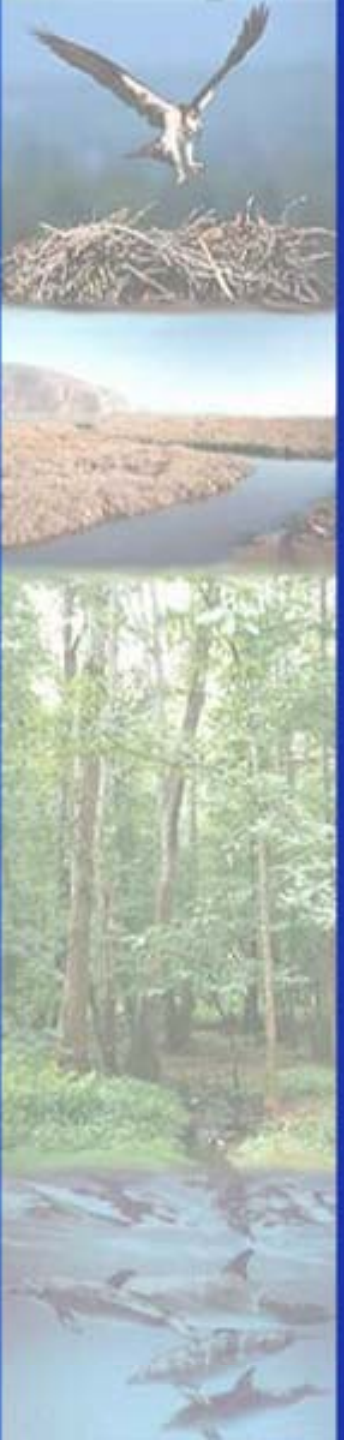
NAVFAC



Accreditation

- Review System Documentation
  - Review V&V
  - Model Documentation Assessment
    - » Software Users Manual
    - » Operational Concept Description
    - » Software Design Description
    - » Software Development Plan
    - » Model Logic Development Plan
    - » Logic Design Description
  - Usage History
  - List of Assumptions and Limits
  - Configuration Management Baseline (Policies and Procedures)
- Interview Subject Matter Experts
- Meets Acceptability Criteria

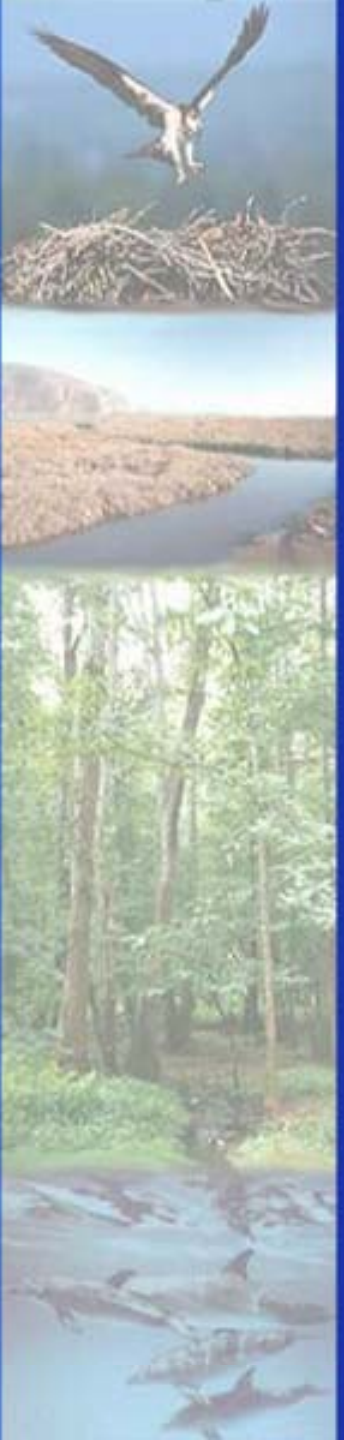
NAVFAC



Accreditation Recommendation

- The Cost-to-Complete (CTC) system be fully accredited for the following intended use:
- To provide a planning, programming, and budgeting system that supports the estimation and development of credible budgetary requirements and financial statement liabilities for the Navy's environmental restoration program.

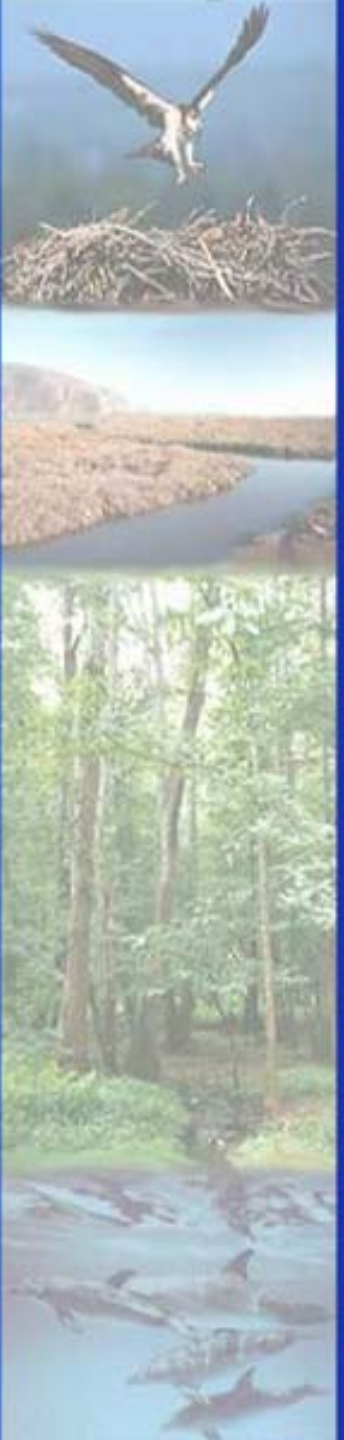
NAVFAC



Lessons Learned

- Understanding the VVA requirement was the biggest challenge
- Coordinate with M&S office early
- Carefully develop acceptability criteria
- Non-V&V data is an important part of the Accreditation process

NAVFAC



Questions

- Questions???
- Contact information if there are any questions in the future:
  - Naval Facilities Engineering Command

NAVFAC