SMS

CMS

CMS-Wave
Wind input, wave generation & growth, wave transformation, diffraction, reflection, run-up, setup, overtopping, structures, surface roller

Current, Water Level, Morphology Change → Wave Height, Direction, Period, Dissipation, Radiation Stresses

PTM
Lagrangian Particle Tracking Model

Hydrodynamics
Tide, Wind, Waves Coriolis, River flux

Waves

Sediment Transport
Advection, Diffusion, Erosion, Deposition, Bed sorting

CMS-Flow

Structures
Jetties, Groins, Weirs, Culverts

Morphology Change
Bed change and layering, Avalanching

Nonuniform and telescoping Cartesian grids, tightly-coupled wave-flow-transport models, parallelized for PCs

BOUSS-2D
High-fidelity, process-based nonlinear shallow-water wave model

GenCade
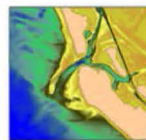Regional Beach and inlet shoal evolution model

Inlet Reservoir Model

CIRP MISSION

- Reduce O&M costs at coastal navigation projects
- Develop tools to support O&M practice
- Transfer technology and products

Jeff McKee, HQ Navigation Business Line Manager
Jeff Lillycrop, Technical Director
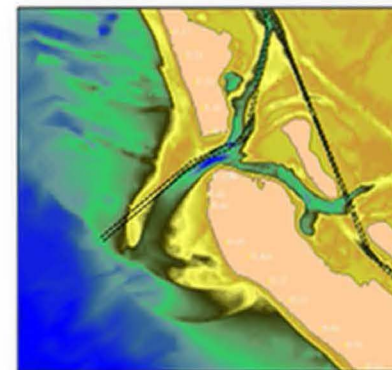Eddie Wiggins, Associate Technical Director

Point of Contact:

Julie Rosati
Program Manager, CIRP
Julie.D.Rosati@usace.army.mil
251-694-3719, 601-634-3005

Visit the CIRP Website:
http://cirp.usace.army.mil

CIRP Wiki:
http://cirp.usace.army.mil/wiki/Main
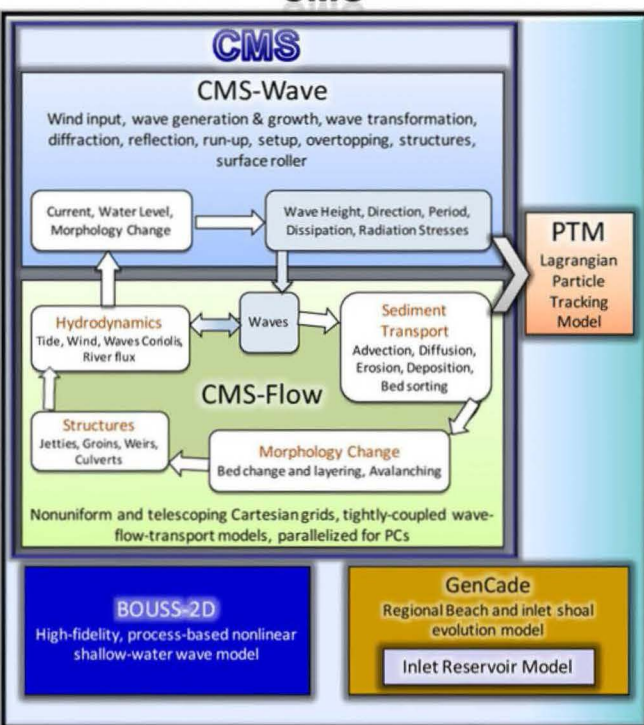
CIRP
Numerical Model Tools and Capabilities

U.S. Army Engineer Research and Development Center
Coastal and Hydraulics Laboratory

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BUILDING STRONG® · · · · · · · *advancing inlet science & engineering*

CIRP

Coastal Inlets Research Program

numerical model tools and capabilities
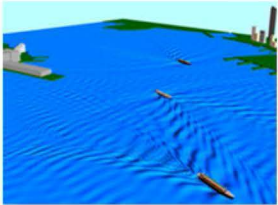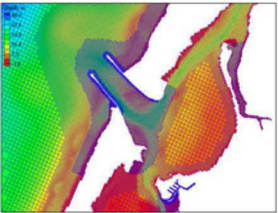
Left margin labels (images): Bouss-1D/2D · CMS-Flow · CMS-Wave · GenCade · Particle Tracking Model
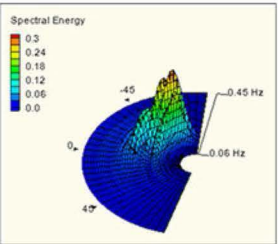
Spectral Energy legend: 0.3, 0.24, 0.18, 0.12, 0.06, 0.0 — -45, 0.45 Hz, 0.06 Hz, 45
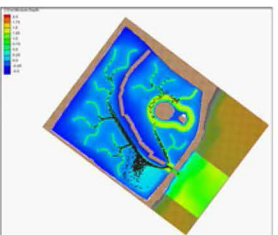
Model	What does it do?	What are typical time scales and platforms?	Where has it been validated?	What are advantages?	What are limitations?	Where do I find info?	Who is the main POC?
Bouss-1D/2D *Wave model for navigation, port/harbor, flood & risk assessment; decision-support*	• High-fidelity, advanced, most accurate model for short and long waves • 1-10 km regions • Wave-structure-ship interactions, ship wake • Surf & swash zone waves (rip currents, runup/over-topping, infra-gravity & tsunamis)	• 20 wave conditions run with rectangular grids in projects • Can be used with one grid or grids for each project alternative • Runs on PC, Linux, and HPCs (supercomputers) • Hours to a week	• 15+ sites including coastal inlets, harbors, ports, flood control structures, and reefs	• Physics & process based; no empiricism • Only DoD model for nonlinear shallow-water waves • Ideal for ports/harbors/marinas, & design/rehab of infrastructure	• Need expertise to run • Time-consuming • Not necessary for all coastal problems • No winds • No unstructured-grid capability	• CIRP, NavSys, FDR, SWIMS websites • Knowledge Hub (KH)	Dr. Zeki Demirbilek
CMS-Flow *2D, depth-integrated*	• Tidal flow, wave-induced currents, sediment transport, and morphology change • Integrated with CMS-Wave	• Runs on multi-core desktop machines • Typical simulation lengths of several months to years	• 20+ sites including coastal inlets, estuaries and beaches	• Integrated system • Robust and fast • Flexible Cartesian meshes • SMS interface • User-friendly	• Depth-integrated • No boundary fitting capability • No swash zone or cross-shore sed transport (yet)		Dr. Honghai Li, Dr. Chris Massey
CMS-Wave *2D, depth-integrated*	• Full-plane spectral wave generation-transformation • Integrated with CMS-Flow • Designed for inlet applications	• Runs on PC in SMS, DOS • Typical simulation lengths of several months to years	• 20+ sites: US East and West coasts, Gulf of Mexico • 5+ laboratory and theoretical studies	• Efficient SMS interface • Theoretical-based wave diffraction, reflection • Includes structure-wave interactions	• Empirical wave breaking formula • Structured grid	• CIRP website • KH	Dr. Lihwa Lin, Dr. Zeki Demirbilek
GenCade *1D regional beach and inlet shoal evolution model*	• Can represent coastal structures, beach fills, dredging and placement • Includes Inlet Reservoir Model* to account for inlet shoal and channel evolution *Also available in PC version	• Runs on PC in SMS • Years to multiple decades • Wave conditions representing 1-10 years	• Basic V&V completed • 5+ sites: Onslow Bay, NC; Sargent Beach, TX; St. Johns County, FL; Point Lookout, NY	• User-friendly; easy to learn • Conceptual model = fast grid creation and set up • Integrates cumulative projects • Fast	• Empirically-based sand transport • Explicit solution scheme (solution stability) • Constrained by standard 1-line model assumptions	• CIRP website • KH	Ashley Frey
PTM *Particle Tracking Model, for 2D/3D hydro models*	• Joint DOER-CIRP product • Coupled to CMS by CIRP • Predicts particle transport pathways and fate • SMS based interface	• Accepts input from CMS and other hydro and wave models • Runs on desktop PCs and HPCs (super-computers) • Seconds to hours	• Basic V&V completed • Detailed V&V studies in progress	• Fast and efficient • Flexible; not tied to any hydro or wave model • SMS interface connects to flow and wave models	• Not designed for sediment transport calcs • Some empirical formulas • Too many particles can slow runtimes	• CIRP, DOER websites • KH	Drs. Tahirih Lackey (DOER), Honghai Li (CIRP), Zeki Demirbilek (CIRP & DOER)