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Engineer Research and Development Center

Laboratory Study of UKC for Charleston Harbor Entrance

Description

A comprehensive series of laboratory experiments were conducted using a model ship and generic physical model of Charleston Harbor, SC entrance channel to validate a probabilistic design tool CADET (Channel Analysis and Design Evaluation Tool) for predicting underkeel clearance (UKC) and to compare to field measurements.

Issue

In April 1999 the Coastal and Hydraulics Laboratory (CHL) conducted a series of field measurements of UKC at the Charleston, SC, entrance channel. Eighteen vessels were boarded and Global Positioning System (GPS) measurements were collected of the ship motions during inbound and outbound transits of the channel. Wave and current data were also collected. UKC is the required minimum distance between the ship's keel and the bottom of the channel. It is a function of the ship size and hydrodynamic characteristics, the channel cross-section and shape, and the ship speed.

Preparing "President Lincoln" model containership for a following seas test physical model run

Products

In FY04, a comprehensive series of laboratory experiments were conducted at the CHL to determine UKC response for a model ship (1:75 scale) in a generic model of the Charleston Harbor entrance channel. A model of the "APL President Lincoln" containership was instrumented with an inertial motion analysis system to measure the six degree-of- freedom ship motions of surge, sway, heave, roll, pitch, and yaw. The characteristic dimensions of the model ship are representative of the Alligator Liberty (outbound) and Munkebo Maersk (inbound) containerships during the 1999 field trials. Seven wave conditions were simulated with the unidirectional wave generator. These waves were calibrated using an array of nine-wave gages array in the basin. The data set of over 168 runs included runs for each of the 7 wave conditions, 3 wave approach angles, 2 vessel speeds, 2 transect directions, and 2 repeats.

Supporting Technology

The CADET (Channel Analysis and Design Evaluation Tool) can be used to predict underkeel clearance in entrance channels for a range of ship, depth, and wave conditions.

Benefits

Since every foot of dredging costs millions of dollars, considerable savings can be realized if the UKC can be safely reduced. This dataset are being used to validate the CADET probabilistic model for predicting UKC.

Sponsors

U.S. Army Corps of Engineers Navigation Systems Research Program.

Point of Contact

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