



**US Army Corps  
of Engineers®**  
Engineer Research and  
Development Center

# Deep Draft Navigation Underkeel Clearance Study (DDNav)

## Description

In FY98 the Coastal and Hydraulics Laboratory began a program to improve the underkeel clearance (UKC) requirements through a series of field and laboratory measurements of 6 degree of freedom (DOF) ship motions for a range of entrance channel configurations, ship, and wave conditions. Field data were collected for a variety of ships in the entrance channels at Barbers Point, HI, and Charleston, SC, using Global Positioning Systems (GPS). Laboratory data were collected in a 1:75 scale of the Barbers Point and Charleston entrance channels using a state-of-the-art motion analysis system (MOTAN) of accelerometers and angular rate sensors for surge, sway, heave, roll, pitch, and yaw.



**World Utility bulk carrier entering Barbers Point Harbor, HI. Inset of CADET underkeel clearance numerical model**

## Issue

The next generation of ships will require deeper drafts and more costly dredging to maintain coastal entrance channels to insure safe navigation. UKC is the required minimum distance between the ship's keel and the bottom of the channel. The UKC is a function of the ship size and hydrodynamic characteristics, the channel cross-section and shape, and the ship speed. Since every foot of dredging costs millions of dollars, considerable savings can be realized if the UKC can be safely.

## Products

The probabilistic design tool CADET (Channel Analysis and Design Evaluation Tool) for predicting UKC for different wave, ship, and channel combinations.

## Benefits

Improve entrance channel design and reduce construction and O&M costs using field and laboratory data and CADET probabilistic model. Provide input to CHL's ship simulator.

## Corps Program

Navigation Research Program.

## Point of Contact

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## Partners

Naval Surface Warfare Center, Carderock Division.