



Ship Motion Studies

safety and more efficient waterways

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## **Ship Motion Studies**

Full-scale ship motion studies quantify actual vessel motions directly. They are essential in the validation of the numerical ship motion model on which underkeel clearance (UKC) requirements are based.

### How do we do it?

#### **DGPS** measurements

Since 1997 OMC has pioneered the use of high accuracy Differential GPS (DGPS) systems in the measurement of vessel motions, including squat, heel, heave, roll and pitch. By placing three DGPS receivers on the vessel, horizontal and vertical vessel motions and the location of the keel relative to the seabed can be determined to centimetre accuracy.

#### iHeave® measurements

Where wave response (heave, roll and pitch) is the primary concern, OMC's award-winning iHeave can be deployed.

iHeave<sup>®</sup> is a simple to use and fully self-contained Inertial Measurement Unit (IMU) device with a custom assembly designed and built by OMC.

iHeave<sup>®</sup> can be mounted inside the bridge of a vessel by a pilot or port personnel with minimal effort.

This device requires no additional cabling or connections on board.

#### Key Benefits of iHeave® measurements:

- Suitable for wave conditions where instrument deployment on the bow is dangerous or impossible.
- Easily carried aboard and set up on the bridge by a marine pilot within minutes.
- Ready to go when the waves look "interesting".
- Additional personnel not required for operations.
- Simpler and cheaper than full DGPS measurements.

## What can Ship Motion Measurements do for you?

- Provide accurate measurements of wave response, squat, and dynamic trim and heel.
- Deliver detailed answers on the actual UKC of vessels in depth restricted waterways.
- Validate the safety of a UKC regime, whether it be a static rule or dynamic regime.

#### Such ship motion studies can also:

- Measure how passing vessels, waves, wind or currents impact on mooring line forces.
- Provide displacements, velocities and accelerations for any point on or within the ship, which can be used to determine the forces such as liquefaction on cargo at sea.







Left & center: iHeave2 displays.

**Right:** trimble DGS unit SPS585

#### Expertise

OMC has developed and validated the innovative hardware and data processing techniques to allow accurate measurements in the most demanding conditions.

Data collected is analysed to isolate wave response motions, squat, trim and heel. Combining these data with high resolution bathymetric data, tidal planes, and resolving for geoid-ellipsoid separations allows the determination of the UKC to centimetre accuracy for the particular transit.

## Experience

OMC has carried out measurements on more than 730 vessels throughout Australia, New Zealand, Asia, Europe and the USA. These have included all major vessel types with varying depth/draft ratios, stability characteristics and speeds. The measurements have been performed in ports, rivers, waterways and the open ocean, in both swell exposed and protected environments.

Vessel Motion Measurements undertaken by OMC have enabled many ports to safely increase the size and drafts of the vessels they can accept. Some examples include record vessels at the Port of Melbourne, Port of Geelong and the Spencer Gulf. Backed by the comprehensive analysis performed by OMC, the Australian Maritime Safety Authority (AMSA) has provided an exemption for Rio Tinto vessels to increase the long-held maximum draft through Torres Strait from 12.2m to 12.5m.



Any technology that reduces the risk of grounding is likely to interest seafarers, shipowners and port operators.

#### from 'Safety at Sea International' 2010, p. 37

## DELIVERING TOTAL PORT SOLUTIONS

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DUKC<sup>®</sup> has assisted more than **120 port facilities, terminals, and** waterways to safely and efficiently conduct **175,000<sup>+</sup> deep draft** transits. Utilising state-of-the-art modelling techniques, DUKC<sup>®</sup> is the world's most comprehensive, and extensively validated, operational UKC management system.

Drawing on a team of engineers, environmental scientists, naval architects, and master mariners, OMC's waterways design expertise is built on a 25 year history of leading the development and implementation of operational UKC technology (Vertical Dimension).

Our unique technology has been extended to include the Horizontal Dimension, port operations and statistical modelling techniques. This enables us to provide an even more precise cost benefit analysis for our clients.

Our optimisation methods enable dredging to be targeted, ensuring maximum return on investment and minimum environmental impact.

# OMC's additional capabilities:

- Horizontal and Vertical Channel Design
- MetOcean Data Measurement and Forecasting
- Capital and Maintenance Dredging Optimisation
- Channel Siltation and Maintenance
- Dynamic Port Capacity Modelling
- Ship Motion Analysis
- Mooring Design and Berth Warning Systems
- Ship Simulation





