

# HYDRODYNAMICS

## BACKGROUND

At Kappa Offshore Solutions marine seismic acquisition is part of our DNA. Our naval architects and marine engineers are not only scientists solving equations in an office. They also acquired years of field experience working on seismic vessels back decks. This is how Kappa Offshore Solutions makes the difference.

## KEY EXPERTISE

Our hydrodynamic models come directly from the field, so that we are able to deliver unique calibrated dynamic analysis of seismic spreads. Our models take into account all relevant environmental and operational parameters, such as irregular waves and currents, shoals, vessel track, or rope failures for example.

With the years this unique know-how was extended to other marine systems such as offshore terminals or offshore support vessel maneuvers for example.

Kappa Offshore Solutions expertise is valued by reference clients around the world among which Total, Kosmos Energy, Trelleborg, Acta Marine, Aselsan or TPSMI.

## SOFTWARE & TOOLS

Orcaflex (FEM)  
SolidWorks (FEM)  
OpenFOAM (CFD)  
NEMOH (BEM)



## METOCEAN DATA ANALYSIS

Prior to begin with any hydrodynamic simulation, Kappa Offshore Solutions analyzes thoroughly any Metocean data available. We then apply state-of-the-art extreme value statistics methods, ensuring the relevancy of our design cases.



## COMPUTATIONAL FLUID DYNAMICS & FINITE ELEMENTS MODELING

Kappa Offshore Solutions models combine CFD and FEM techniques. Vessel motions response amplitude operators and hull resistance for example can therefore be fully incorporated in the dynamic fluid structure interactions calculations.



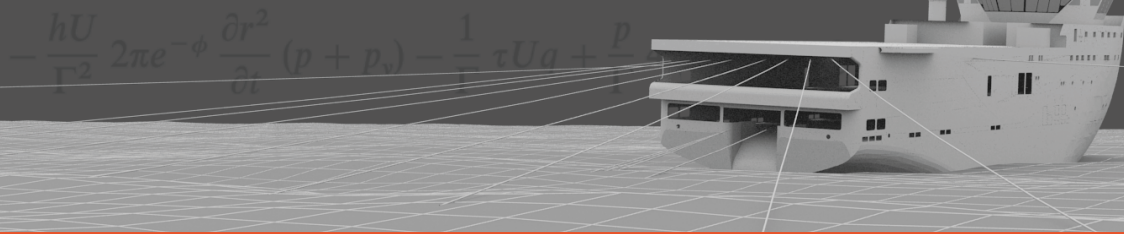
## RESEARCH & DEVELOPMENT

We strive to improve continuously our methods and processes to add capabilities to our models. We can develop tailor-made Python scripts to support our clients' R&D groups in modeling any kind of particular situation.



## FIELD PROVEN SEISMIC SPREAD MODELS

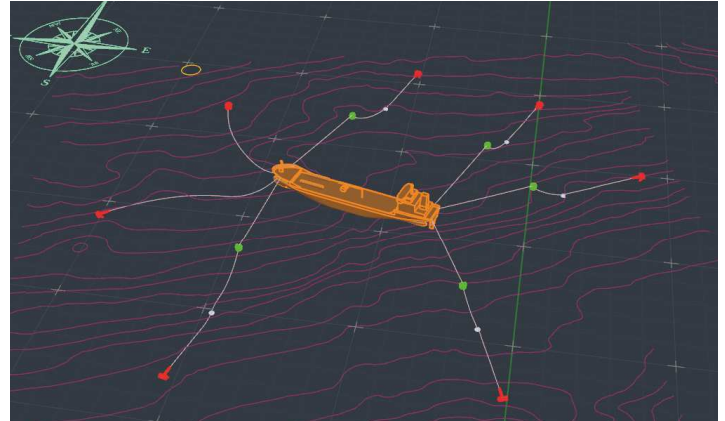
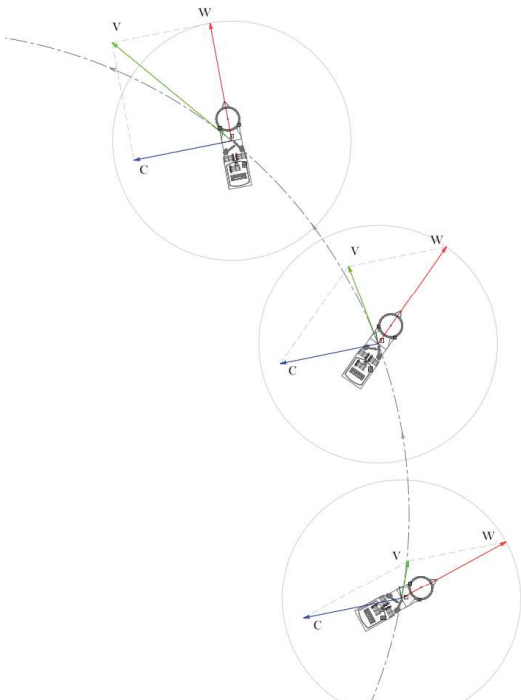
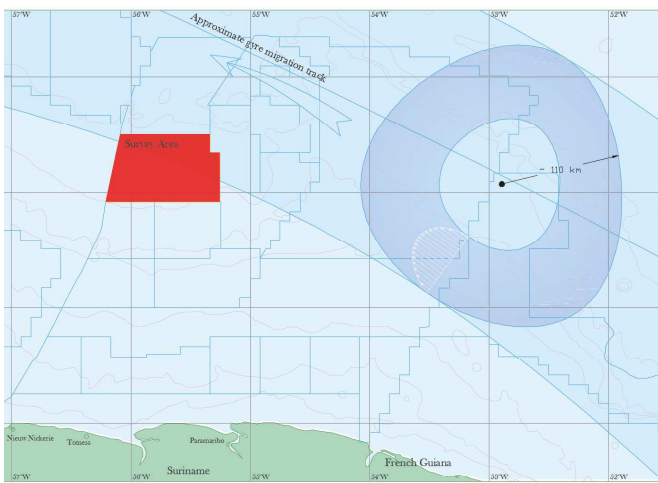
Kappa Offshore Solutions models incorporate more than 10 years of field measurement campaigns realized on board several seismic vessels using calibrated gauges. Our results can be trusted.



## REFERENCE PROJECTS

### MULTI-BUOY MOORING DESIGN

Kappa Offshore Solutions completed the design of an offshore import terminal and delivered the terminal operations booklet in partnership with diving company TPSMI. Operator Total Equatorial Guinea was particularly pleased with the strict adherence to OCIMF guidelines observed by Kappa Offshore Solutions all along the design process.



### ULTRA-WIDE 3D SEISMIC SPREAD CROSSING CURRENT GYRES

Kappa Offshore Solutions was contracted by Kosmos Energy to qualify and quantify the operational risks involved in towing an ultra-wide seismic spread off the Northern coast of South America. The area is characterized by the presence of gyres of strong currents crossing periodically the survey area. To output the relevant metrics and help decision making with regards to the seismic spread to be towed, we had to push the limits of hydrodynamic simulation capabilities again. Our model included in particular:

- Vessel motions RAO's
- Follow track autopilot modes
- Steerable streamers with fan and slant towing geometries
- Fully developed environmental parameters with irregular wave spectrum and horizontal current gradients

