



# Working with us

## Shipping

National Oceanography Centre

**WORLD CLASS MARINE SCIENCE AND TECHNOLOGY FOR YOUR BUSINESS**



National  
Oceanography Centre  
NATURAL ENVIRONMENT RESEARCH COUNCIL

[noc.ac.uk](http://noc.ac.uk)

**NERC** SCIENCE OF THE  
ENVIRONMENT

The National Oceanography Centre is the UK's leading institute for integrated ocean research and technology development from the coast to the deep ocean. Working with our partners, we provide large scale, long-term, marine science capability including: major facilities, sustained ocean observing and modelling, mapping and survey, data management and scientific advice.



## The Shipping Industry

The shipping industry could lay claim to being the world's first truly global industry. Likewise it could claim to be the industry which, more than any other, makes it possible for a truly global economy to work. It connects countries, markets, businesses and people; allowing them to buy and sell goods on a scale not previously possible. As consumers, we have become used to seeing goods from all parts

of the globe readily available in the stores we visit.

The oceans cover 70% of the Earth's surface and contain 97% of the biosphere by volume. NOC's research from the coast to deep oceans and the shipping industry are inextricably linked and we are working alongside the industry, and its suppliers, to address the following challenges and opportunities.



# Challenges

## Ballast water discharges, invasive species and other discharges

Large commercial vessels routinely discharge ballast water, grey and black water, bilge water, and other discharges incidental to normal vessel operations and consistent with international and national standards. Ballast water discharges are a concern due to their potential to transfer aquatic invasive species from one location to another with consequent changes in regional and local ecosystems. Hull fouling, which is another potential factor for the transfer of aquatic invasive species and that also reduces the

efficiency of the vessel as it moves through the water, is managed through the use of anti-fouling systems.

Sewage, grey water and other discharges are regulated to prevent environmental damage while facilitating safe and efficient vessel operation. Accidental spills of oil and fuel can also cause significant damage to the environment and extensive standards have been put in place to prevent such accidents and to respond to such incidents when they do occur.

## The Arctic Ocean in a time of climate change

Driven by anthropogenic climate change, the Arctic is losing its cover of permanent sea-ice, and is forecast to be seasonally ice-free by around 2040.

In response, it is expected that the region will open up for industrial activity, in particular for the extraction and transportation of oil from shelf and deep waters.



Though seasonal sea-ice decline facilitates such activity, winter sea-ice will remain an issue, compounded by forecasts of increased wind, higher waves and stronger currents. As a

result, the Arctic will continue to be a challenging operational environment, one where some potential risks will even be greater than at present.

## Ships of Opportunity Programme

Approximately 25% of the carbon dioxide (CO<sub>2</sub>) produced by fossil fuel combustion enters the ocean. Without this, the rate at which CO<sub>2</sub> is building up in the atmosphere would be 50% larger than it is today. However, the CO<sub>2</sub> is causing measurable reductions in ocean pH, a factor which is likely to be affecting marine biota.

Understanding how this sink, and the associated acidification, works, its geographical distribution, whether it will continue to work at its current rate and the likely fate of this stored material are therefore key research issues.

A declining oceanic sink has been predicted by models but model outputs vary considerably and are

no substitute for high quality *in situ* measurements that will be archived and used as an international resource to monitor changes into the future.

This is where you, a leading shipping company, can help. To find out more, please see NOC Ships of Opportunity Partnership Opportunity on page 8.



# NOC's Science and Engineering

## Sensor technologies

The NOC is at the forefront of research, development and manufacture of lab on chip sensors for ocean science and other industry applications. We are working collaboratively with the environmental sensor industry to develop high performance and low power *in situ* sensors to measure a variety of parameters including pH, macro and micro nutrients, trace metals, heavy metals, organic pollutants, bio-toxins, pathogens and organisms (including invasive and harmful species) and we envisage that these will be valued by the shipping industry to address the ballast water monitoring and/or pollution challenges in the coming years.

## The Marine System Modelling Group

The Marine System Modelling Group at the National Oceanography Centre has unique expertise in modelling of the Arctic Ocean including:

- Cutting-edge, high resolution numerical global ocean models with a focus on the ocean and sea-ice dynamics, marine ecosystems and biogeochemistry of the Arctic Ocean
- Future projections of the Arctic sea-ice retreat, ocean circulation and biogeochemistry under IPCC climate change scenarios
- Computationally efficient Lagrangian methods that allow





fast assessment of the impact of ocean circulation and sea-ice drift on the propagation of spilled oil or other marine pollution in the Arctic.

### Available models

- NEMO (Nucleus for European Modelling of the Ocean ([www.nemo-ocean.eu](http://www.nemo-ocean.eu)) global model at  $1/12^\circ$  resolution with ocean biogeochemistry (30 year hindcast)
- Forward ocean projections at  $1/4^\circ$  resolution forced by IPCC scenarios to year 2099
- Novel ice and wave dynamics that allow simulations of the evolution of sea-ice concentration and fragmentation, with realistic ice floe sizes
- Offline 3D Lagrangian methods that allow oil spills propagating with ocean currents and sea-ice drift to be tracked.
- A wide range of models available through our Microsoft Windows based POLPRED software developed by the Marine Data Products team.

### Key areas of our industry and policy related modelling applications in the Arctic:

- Future navigability of Arctic Sea Routes
- Oil spills in Arctic: risks, consequences and environmental impacts
- Future of Arctic Ocean ecosystems and acidification
- Impact of climate change on living marine resources in the Arctic
- Invasive species: Will the melting of Arctic sea-ice allow alien invaders to cross between the Pacific and the Atlantic?



## NOC Ships of Opportunity Partnership

The NOC also invites shipping companies to speak with us about our growing Ships of Opportunity program.

This partnership proposal is a follow up to the SWIRE NOCS Ocean Monitoring System (SNOMS) which was a ground breaking joint research project supported by the Swire Group Trust, the Swire Educational Trust (who sponsored a PhD studentship), the China Navigation Company (CNC Co) and the Natural Environment Research Council.

With our sensor system installed on Swire's *Indotrans Celebes*, we collected high quality data on concentrations of CO<sub>2</sub> in the surface layer of the ocean from 2007 to 2012 and contributed to the international effort to better quantify (and understand the driving processes controlling) the exchanges of CO<sub>2</sub> between the ocean and the atmosphere.

By partnering with the NOC, you will play a vital role (i.e. providing your ship as a platform) in collecting critical *in situ* data including air and water CO<sub>2</sub> concentrations, temperature, ocean pH and total dissolved gases which can be 'downloaded' in near real-time for the benefit of the international science community and society as a whole.

We believe that partnering with us would offer a range of benefits to your company including:-

- Being a pioneer in ocean stewardship issues and assuming a leadership role in mobilising future investment and involvement in global environmental science.
- Excellent opportunities for public outreach and promotional activities worldwide in climate research.

- The ability to add this vital ocean climate research to your corporate social responsibility program.
- Positively engagement of your crew and staff in ocean climate science.

If you are interested to discuss this opportunity, please email us at:  
[business@noc.ac.uk](mailto:business@noc.ac.uk) or call: 023 8059 6103

We look forward to hearing from you

