

# Wake Modelling

Modelling aerodynamic interactions between bodies, whether they are vehicles, wind turbines or buildings, relies on capturing three complex physical processes: the generation of the wake by the upstream body, the way the wake is transported downstream, and way it affects the downstream body.

Frazer-Nash has the knowledge, experience and tools to model all three of these aspects in a range of ways to get the best combination of accuracy and value for money.

We can also apply optimisation methods to minimise aerodynamic interactions and/or harness them to our customers' advantage.

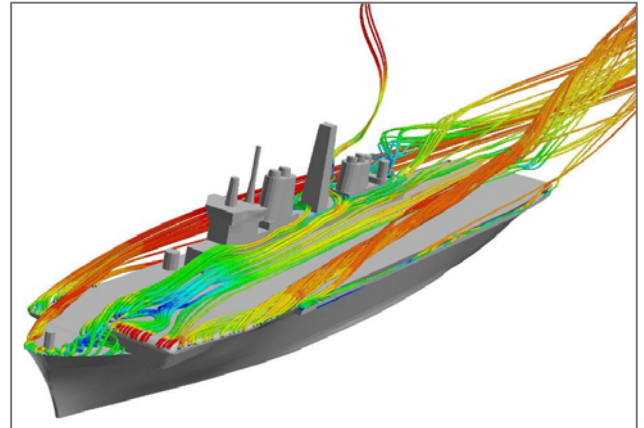
## THE PROBLEM

Aerodynamic interactions are always complex and frequently problematic. Often, the challenge is to minimise the effect of this interference, for example to reduce the vibration of a helicopter rotor or to maximise the performance of a wind farm. Sometimes, the interaction is inevitable and the challenge is to mitigate its effects in other ways, for instance modelling the air wake around an aircraft carrier and using the results to make flight simulators more realistic. Occasionally, the interactions can be harnessed to improve the performance of the system as a whole, such as the design of high lift devices on aircraft. We tackle all of these scenarios and more, taking ownership of our customers' problems and proposing solutions to their needs.

## OUR APPROACH

We have one of the largest independent fluid dynamics teams in the UK. We pride ourselves on applying the right tools to any problem, whether that is advanced Computational Fluid Dynamics (CFD) simulation, hand-calculations or practical testing.

In many situations, the best combination of insight and value-for-money can be obtained by carrying out hand-calculations or by building up simple numerical models of the system in question. Our recent applications of this approach include optimising the layout of sub-sea turbines and analysing the performance of a wave power device. This approach is fast, inexpensive, flexible, and can be tailored to the problem.



There are a large class of tools which are more sophisticated than hand-calculations but are still simpler and less computationally expensive than CFD. Our staff have extensive experience of developing and using these kinds of tools for applications including studying rotor interactions on helicopters and optimising the aircraft performance.

CFD is an extremely powerful toolset which can capture a wide range of physical processes. We have carried out analyses of a huge number of flow regimes including modelling wakes from buildings, predicting the performance of aircraft and calculating loads on marine structures. We have also carried out extensive validation work on new CFD technologies for customers such as Airbus, and have been amongst the first in industry to apply cutting-edge techniques like Large Eddy Simulation (LES) to practical problems.

Sometimes, only a practical test can provide the quality and quantity of data required. We help our customers to plan, carry out and interpret the results of various types of experiments including wind tunnels tests and assessments of full-scale prototypes.

## THE OUTCOME

We strive to take a systems approach to solving customers' problems, focussing everything we do on delivering the best possible value to the customer. In the case of wake modelling, that means understanding the trade-offs between the various design options and understanding how aerodynamic interactions and wake effects influence those choices, then, helping our customers make the right engineering and investment decisions for their businesses.

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