



Press release
Nantes, 3 march 2016

Centrale Nantes and Bureau Veritas establish an international research chair on ships of the future, in partnership with HydrOcean and Nextflow Software.

This Chair has an exceptional 10-year funding of € 7.5 million. An amount commensurate with the competitiveness challenges of the world's shipbuilding industry and rarely achieved at the level of higher education and research in France

Centrale Nantes, with its excellent reputation in the field of numerical and experimental hydrodynamics, and Bureau Veritas, a world leader in testing, inspection and certification services for shipping and offshore structures, created **this international chair in Hydrodynamics and Marine Structures in order to make significant improvements in the safety and performance of ships of the future**. This ambitious research programme also involves two spin-offs from Centrale Nantes:

- HydrOcean, key service provider for the evaluation and optimisation of marine and offshore structure performance,
- Nextflow Software, start-up publisher of fluid mechanics software.

Maritime issues

Whether for civilian or military ships, offshore engineering or marine renewable energies, hydrodynamics and hydro-structural interactions have a direct impact on the performance and safety of marine systems. These systems must also meet increasingly precise and complex standards and certifications. In this context, having accurate numerical means of assessment is a major asset for a classification society such as Bureau Veritas, enabling specific approvals, new standards development through virtually unlimited access to digital assessments, or services providing to assess or optimize vessels and structures at sea.

A fast-growing market

The global shipping market is huge and growing fast. It is expected to represent 2 000 billion euros in 2020. Some 50 000 merchant vessels are sailing all over the world, with transport volumes of around 9 billion tonnes per year, or 90% of the world's total traffic. In France, the shipbuilding and repair industry employs 42,000 people. It ranks 6th in the world and 2nd in the European market for civil and military products ¹.

This explains the growing economic interest of maritime trade. However, the sector must be transformed in order to remain competitive and to develop even further, with the maritime territory offering capacities that are still undeveloped but which must be protected with more reliable and less energy-consuming ships, while the air and land circuits have arrived to saturation and are up to 4 times more expensive.

¹ Source: Cluster Maritime Français

This is where Centrale Nantes and Bureau Veritas come in, with the support of HydrOcean and Nextflow Software. The involvement of these four partners in the chair **will foster the emergence of technological innovation** with regards to the concept, design and performance of ships and marine structures, environmental protection and safety standards, reduced fuel consumption.

The chair benefits from exceptional resources:

To carry out this research and development program, the partners will bring their unique expertise and means:

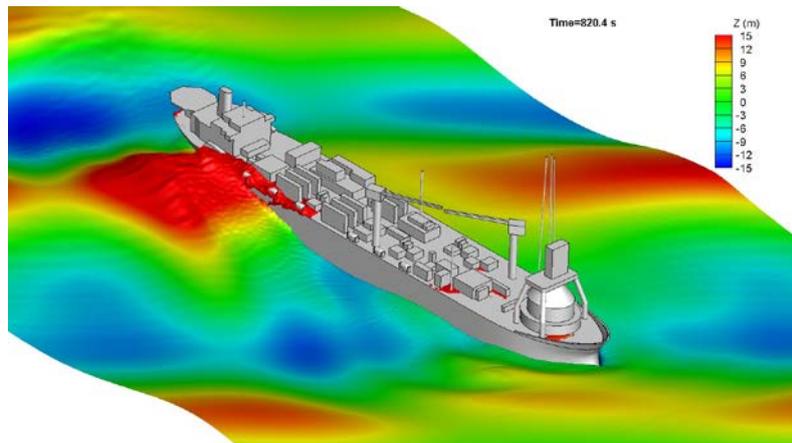
- Centrale Nantes wave tanks, which can simulate the impact of extreme storm conditions (generating the highest waves in Europe) on models.
- Cutting-edge numerical simulation software, developed by Centrale Nantes, Bureau Veritas, HydrOcean and Nextflow
- High performance computing capacity particularly with the Centrale Nantes 10,000-core supercomputer, making possible simulations that were once beyond the reach of the partners.



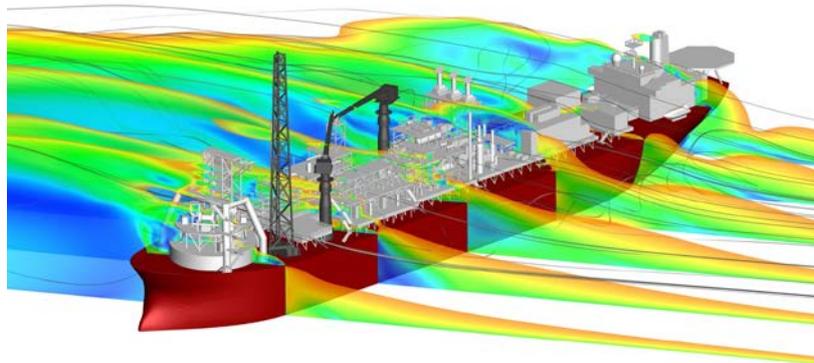
Les moyens d'essais de Centrale Nantes : bassin de houle et bassin de traction

*"This chair reflects Bureau Veritas' commitment to call upon the innovative capacity of the best engineers and researchers in order to establish the optimum conditions for the development of the shipping industry of the future, and thereby proposing new services to our clients to improve their performance with regard to industry standards and regulations for quality, health, safety, environmental protection and social responsibility" stated **Philippe Donche-Gay, Executive Vice-President, Marine and Offshore Division, Bureau Veritas.***

*"This new step is line with our long-established collaboration between the four establishments in the maritime field. Through the intensive use of numerical simulation tools, it will allow us to go further and more quickly together towards designing the ship in demand in civil and military sectors" noted **Arnaud Poitou, director of Centrale Nantes.***



Example of a wave impact simulation on an offshore vessel



Example of aerodynamic simulation to determine the anchoring forces and the risks of explosion



A scientific and technical program combining numerical simulation and hydrodynamic experiments

Under the supervision of **David Le Touzé, Professor at Centrale Nantes and Chairholder** and under the supervision of a Strategic Committee, the work will aim at achieving scientific and technical advances in the numerical and experimental modeling of hydrodynamic and hydro-structural problems in the maritime field.

David Le Touzé is director of the “Hydrodynamics, Interfaces and Interactions” team at the Hydrodynamics Research Laboratory at Centrale Nantes and is known internationally for his expertise on the SPH² method (Smoothed Particle Hydrodynamics) for which he received in June 2015, with his Italian colleagues Andrea Colagrossi and Matteo Antuono of the CNR INSEAN Institute, the Joe Monaghan Award for the best article in international review that has brought significant advances to the theoretical understanding of the SPH method.

Complementarity of developed means

To achieve the best possible treatment of hydrodynamic and structural problems, the work of the Chair will be based on 3 complementary means:

- **Development of numerical simulation tools.** The advantage of numerical simulation on direct basin experimentation is the saving of time and speed. However, ultimate reliability and measurement of results will be obtained in a swell basin and nowhere else. This complementarity summarizes the effectiveness of the Chair's work.
- **The use of hydrodynamic testing facilities at Centrale Nantes, which are among the largest in Europe**
- **Development of methodologies** to deal with a given hydrodynamic or hydro-structural problem in the most efficient way

Three lines of research and development

Research and development will focus on three key areas:

- **Ship safety:** the themes covered will include the effects of green water (water embarkation on bridges and impacts on super-structures), the hydro-structural response of the ship's beam to slamming efforts in the swell, extreme and non-linear swell-structure interactions, simulation of invasion ...
- **Interacting bodies and flexible connections:** the subjects covered will concern, among others, the behavior of ships with torque subjected to swell and wind, the modeling of the anchorages and the low frequency phenomena on irregular wave, the laying of packages...
- **Swell performance:** the topics covered will include the estimation of resistance and added power on wave, nautical qualities in the wave (including wave maneuverability), damping coefficients on wave ...

² Calculation method to simulate fluid flows



About Centrale Nantes :

Centrale Nantes is a French engineering school and member of the Ecoles Centrales Group. Its graduate, master and PhD programmes are based on the latest scientific and technological developments and the best management practices. Founded in 1919, Centrale Nantes' 40-acre campus welcomes 2050 students, including 1340 graduate students, 200 sandwich-course students, 240 PhD students and 270 Master students.

With a comprehensive range of platforms for numerical simulation, wave-tank modelling and on-site test facilities (SEM-REV test site), Centrale Nantes is heavily involved in training, research and innovation in the maritime sector (shipbuilding, offshore, marine renewable energies). In particular, it has developed innovative numerical methods allowing simulations of hydrodynamic flows to be carried out.

About Bureau Veritas :

Bureau Veritas is a global leader in Testing, Inspection and Certification (TIC), delivering high quality services to help clients meet the growing challenges of quality, safety, environmental protection and social responsibility. Created in 1828, the group has 66,000 employees working in 1,400 office and laboratories all over the world. The Marine & Offshore Division provides classification and certification services for ships and offshore structures. Its excellent scientific reputation is built on its research work and collaboration with the marine industry as a whole. The results obtained allow Bureau Veritas to provide technical support to shipowners, shipyards and other industry operators and to improve regulatory requirements and compliance.

About HydrOcean :

HydrOcean offers design support in the maritime field, with the use of innovative numerical simulation tools capable of accurately simulating the most simple to the most complex hydrodynamic phenomena. HydrOcean was founded in 2007 by Erwan Jacquin and Centrale Nantes, and acquired by Bureau Veritas in September 2015 with the objective of pursuing its development abroad. Since its inception, HydrOcean has maintained an efficient research partnership with Centrale Nantes paving the way for the joint development of innovative tools in excellent conditions, providing a clear competitive advantage.

About Nextflow Software

Nextflow Software is a publisher of fluid mechanics and hydrodynamics software. It was founded in July 2015 as an extension of the HydrOcean's software publishing activity. In collaboration with Centrale Nantes it develops innovative software for the industrial market. Its primary focus is on innovative fluid mechanics software for industry: automotive, aerospace, manufacturing, marine and offshore etc. Nextflow will take an active part in the Chair using its expertise to develop and bring innovative software to market.

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