Annual Report

2020

SFI BLUES

sfi Centre for Research-based Innovation

The Research Council of Norway

Contents

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SFI BLUES

Summary

SFI BLUES is a research centre focusing on floating structures for the next generation of ocean industries. SFI BLUES is funded by the Research Council of Norway and the centre partners through the centres for research-based innovation scheme, SFI (https://www.forskningsradet.no/en/apply-for-funding/funding-from-the-research-council/sfi/). The main objective of SFI BLUES is to enable the Norwegian industry to create novel floating structures which satisfy the needs and requirements from new markets and applications, particular ly to renewable energy (wind and solar), aquaculture and coastal infrastructure.

2020 was a special year due to the pandemic, however, it was also a year for acceleration of green transition and for new possibilites. For Norway, 2020 was the year when floating offshore wind gained momentum in the industry, mainly due to the opening of areas for offshore wind energy development at *Utsira Nord* and *Sørlige Nordsjø II*. The development of floating solar is rapidly increasing and moving into exposed areas with rough seas both in Norway and abroad. The comprehensive work related to floating bridges and submerged floating tunnels for the Coastal Highway on the west coast of Norway continued. Several novel structures for salmon farming, developed as part of the development licenses, were realized and put into operation. The partners of SFI BLUES were involved in all of this.

SFI BLUES was awarded funding from the Research Council in June 2020, as one of 22 new centres for research-based innovation (SFI). This was the fourth call for SFIs. The second half of 2020 was used to formalise the centre in a collaboration agreement, establish the annual working plan for 2021 and plan the official kick-off for January 2021. As the official start was in January 2021, no scientific work was performed in 2020, but the first PhD candidate of SFI BLUES was recruited.

Photo credit: Equinor

Vision and objective

"Floating solutions to present and future industrial and societal challenges"

The overall objective of SFI BLUES is to enable the Norwegian industry to create new types of floating stationary structures which satisfy the needs and requirements from new markets and applications. Particular attention is devoted to floating structures for renewable energy (wind and solar), aquaculture and coastal infrastructure.

The world is facing several industrial and societal challenges, and the ocean provides great opportunities which can contribute to solving several of them. Due to the ongoing transition in the world's energy mix to meet the goals stated in the Paris agreement, the need for clean energy is now global. Changes in diets and an increase in the world's population also generate a need for safe and healthy food. Further, in a changing climate, requests for increased mobility as well as shortage in land area, introduce a need for resilient infrastructure in coastal waters for transportation, as well as industrial and residential developments. Floating stationary support structures have a huge potential to contribute to solving these challenges. New applications imply new needs and requirements to safety, sustainability, cost, function, and operation. This leads to structures where we have limited experience. These structures will be highly diverse, but also have essential research needs in common.

The secondary objectives of SFI BLUES are:

- To understand the requirements of novel floating structures related to function, safety, cost, operation and sustainability, in order to develop optimized solutions.
- To develop numerical and experimental high-quality, validated design tools.
- To base the design on reliable descriptions of the marine environment.
- To understand the interaction between the environment (wind, waves, current) and structures.
- To develop structures with sustainable, safe and cost-efficient materials.
- To develop mooring systems and anchors to keep the floating structures in position.

Research plan and strategy

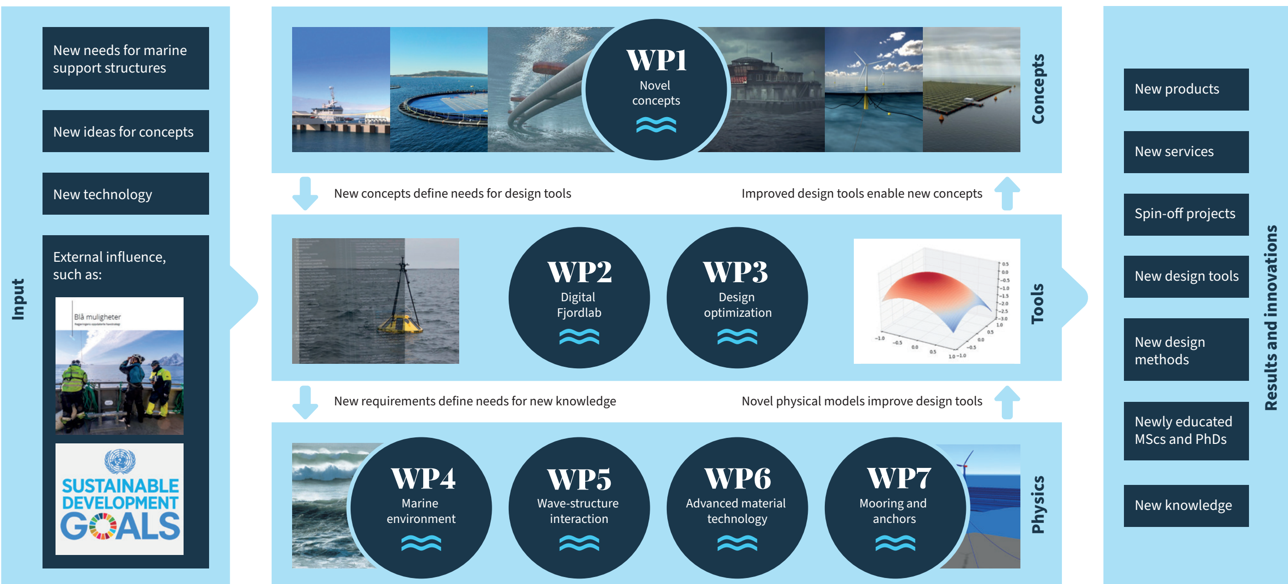
The work packages describe the long-term scientific plans for SFI BLUES. The actual research is organised as projects with a duration of one to four years. The projects are detailed in the annual work plan, which will be updated with new projects each year.

Requirements and needs for novel floating structures will be addressed in *WP1 Novel concepts* and used as input to all the other work packages. Work packages 4 to 7 will work on the underlying physics, and *WP2 Digital Fjordlab* and *WP3 Design optimization* will integrate results from these work packages into tools and methods to enable the design of new floating structures.

The results of SFI BLUES will be new methods, design tools, solutions and competence, incorporating digitalisation and enabling technologies, to accelerate the innovation and development of new types of floating structures. SFI BLUES will also supply the Norwegian industry with a skilled workforce through researcher training (PhDs and postdocs) and education (MSc).

SFI BLUES is positioned at the core of an already established portfolio of research and innovation projects involving all the partners and will tie these together to bring momentum and alignment into the development of the next generation of ocean structures.

To strengthen the vision and goals of SFI BLUES, the partners will seek funding for associated projects from the Research Council of Norway, Innovation Norway, and European funding schemes such as Horizon Europe.



WP1 Novel concepts

OBJECTIVE

The innovation objective is to support developers of novel ocean structures, by bringing together industry experts and research communities to discuss and solve complex technical issues. The scientific objective is to identify and understand technology and knowledge needs, and to convert these into research activities that can be addressed and pursued by the other WPs.

MOTIVATION

The distinct requirements for novel floating structures for renewable energy production (floating offshore wind, floating solar plants), food production (aquaculture), and coastal infrastructure (floating tunnels and bridges, floating terminals and docks, and floating recreational or urban facilities) with respect to function, cost, sustainability and operability will be identified. To define developmental needs, it will be important to understand which features characterize novel marine structures, and what the differences compared to traditional marine structures are. Further, it will be essential to identify how novel marine structures challenge present design methods and design tools, and which new knowledge and physical understanding is required to realise them. The composition of partners in BLUES will make it possible to understand the needs from research via engineering and technology providers, to end users and operators.

Arctic Offshore Farming in elevated position. Photo credit: Aker Solutions

WP2 Digital Fjordlab

OBJECTIVE

The overall objective is to reduce the threshold for designers to develop innovative coastal structures and designs, by developing a system where a designer can easily explore or experiment with different concepts for a given site, while utilising the latest models developed by researchers to represent different aspects of the analysis, from site and environmental description, to structural loads and responses.

MOTIVATION

The current design process for marine and coastal structures is complex, including environmental impact assessment, concession application, wind, wave and current measurement campaigns, site investigations, establishing design actions, conceptual design, detailed design, construction, installation, maintenance and plan for decommissioning. This may be a high bar for developers of novel concepts. To reduce this threshold, an integrated workbench, Digital Fjordlab, will be implemented. This will give access to background wind, wave, current and tide data for any selected site along the Norwegian coastline and can import, keep and integrate data from specific site investigations. Based on these data, Digital Fjordlab will provide reliable design conditions and design actions for the designer, and finally communicate seamlessly with established design tools. The workbench will rely on current state-of-art models and software tools. Adopting the current and up-coming standards for data communication and integration, the workbench facilitates utilisation of new research outcomes in the form of mathematical models and simulation tools. A critical issue is to ensure that the system gives reliable output. Data from the E39-project will provide extensive and valuable benchmarks for validation for environmental conditions. There is also a large untapped source of data in the measurement campaigns performed for aquaculture sites along the Norwegian coastline. The model and full-scale measurements provide the validation source for the structural loads and response models.

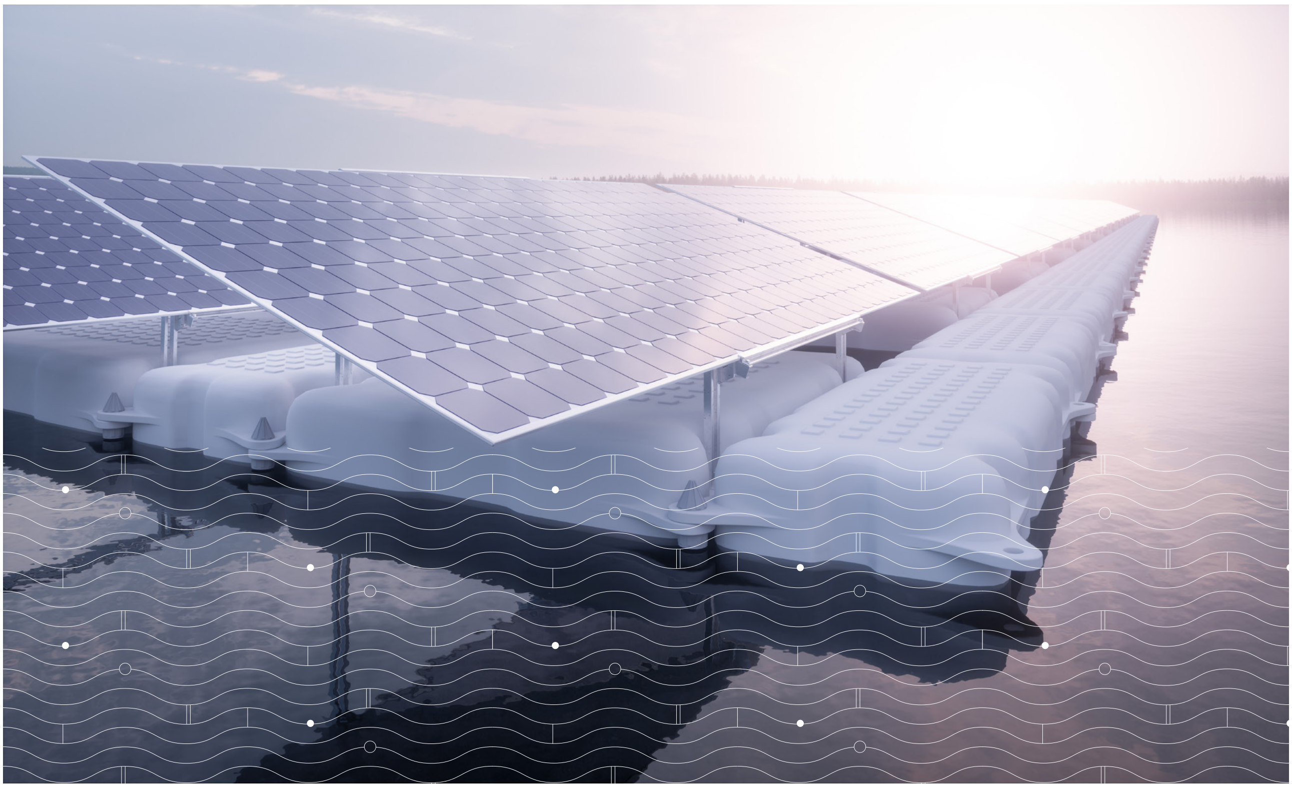



Photo credit: Sevan SSP

WP3 Design optimization

OBJECTIVE

The objective of WP3 is to identify, develop, and apply multidisciplinary design optimization (MDO) strategies which are appropriate for novel floating marine structures. The developed numerical framework for exploring a wider design space, with sufficiently validated simulation tools, will enable innovative design solutions that traditional strategies may not be able to identify.

MOTIVATION

An important step in designing novel floating structures for new application areas, is to identify performance criteria which specify what would be considered the "best" design. Formulating an optimization problem requires us to quantify objectives such as costs (CAPEX and OPEX), sustainability, function, performance and safety. Installation and sustainability considerations have traditionally been ignored in design optimization studies within marine technology. Having mathematically defined these objectives, existing MDO techniques can allow us to examine the trade-offs between different objectives and identify more optimal designs. The numerical tools for different disciplines such as structures, hydrodynamics, aerodynamics and control need to be implemented in MDO frameworks – including the computation of derivatives for gradient-based optimization techniques (which are anticipated to be best for the large number of design variables in question). The calculation of derivatives when the numerical methods depend on complex mathematics and include stochastic input requires further research. Furthermore, there are unanswered questions regarding the level of fidelity required for accurate optimization of novel floating structures.

WP4 Marine environment

OBJECTIVE

The objective of WP4 is to develop improved methodologies to determine coastal metocean conditions using consistent open access hindcasts of atmospheric and oceanic parameters, in order to reduce and quantify uncertainties in the environmental description for design basis.

MOTIVATION

The semi-sheltered coastal region often allows lower design criteria than offshore, but complex topography, bathymetry and site conditions can make it more challenging to determine the design action on a floating structure. Wind jets, partial wave sheltering, and periodically strong currents may lead to large spatial variability across a fjord. Shallow water, tides, tsunami-risks and wave breaking must also be taken into consideration. Novel coastal structures may have a horizontal extent and lifetime that makes it necessary to take these spatial variations as well as possible future changes into account. To reduce the threshold for designing new large structures in a reliable manner and at an appropriate safety level, knowledge of this variability should be available at an early stage of the design process. There is a need to calculate design actions for new structures and in new locations in a safe, optimal and efficient manner based on hindcast data sets, and with as few location-specific measurement campaigns as possible. There is also a need for cost-effective methods for seabed characterisation.

Photo credit: AMC Dissing + Weitling

WP5 Wave-structure interaction

OBJECTIVE

The objective of this WP is to broaden our understanding and knowledge on the wave loads and responses of future types of cost-efficient structures that can meet the demand for large-scale harvesting of food and energy, as well as new types of coastal infrastructure, with rational models for wave-structure interaction as a goal.

MOTIVATION

Novel concepts require dedicated studies. Wave-current-structure interaction is one of the main elements. For both existing and novel fish farms, as well as floating solar, several needs are identified in the research tasks below. For offshore wind and floating bridges, ports and cities, general needs are identified, but specific research tasks are to be decided during the project. Some of the research tasks that will be adressed are:

- Hydrodynamic interaction between large-volume bodies and nets
- Membranes and elastic tori in combination as decks for solar panels
- Snap loads in nets and membranes
- Hydrodynamic interaction for massively modular structures

Photo credit: Ocean Sun

WP6 Advanced material technology

OBJECTIVE

The objective of the WP is to provide support and expertise to innovative design in terms of material behaviour. The material solutions proposed will be an optimum between safety, reliability and economic efficiency.

MOTIVATION

Evaluation of mechanical properties of materials and components to provide designers with the most reliable data is crucial. How to obtain such properties is well known for metallic materials and concrete, but more challenging for polymers and composites. The constitutive models used in FEA have also increased complexity, and subsequently, experimental calibration is fundamental to get the right parameters. Modularity and mass production are two important features of next-generation marine structures. It is thus important to consider manufacturing technology during the design phase along with the choice of materials to optimise production costs. It is crucial to have a good overview of manufacturing techniques in order to suggest adapted material solutions. Next generation structures will have new requirements in terms of functionalities, thus requiring multi-material expertise. Numerical tools and adapted constitutive models have a key role in multi-material design.

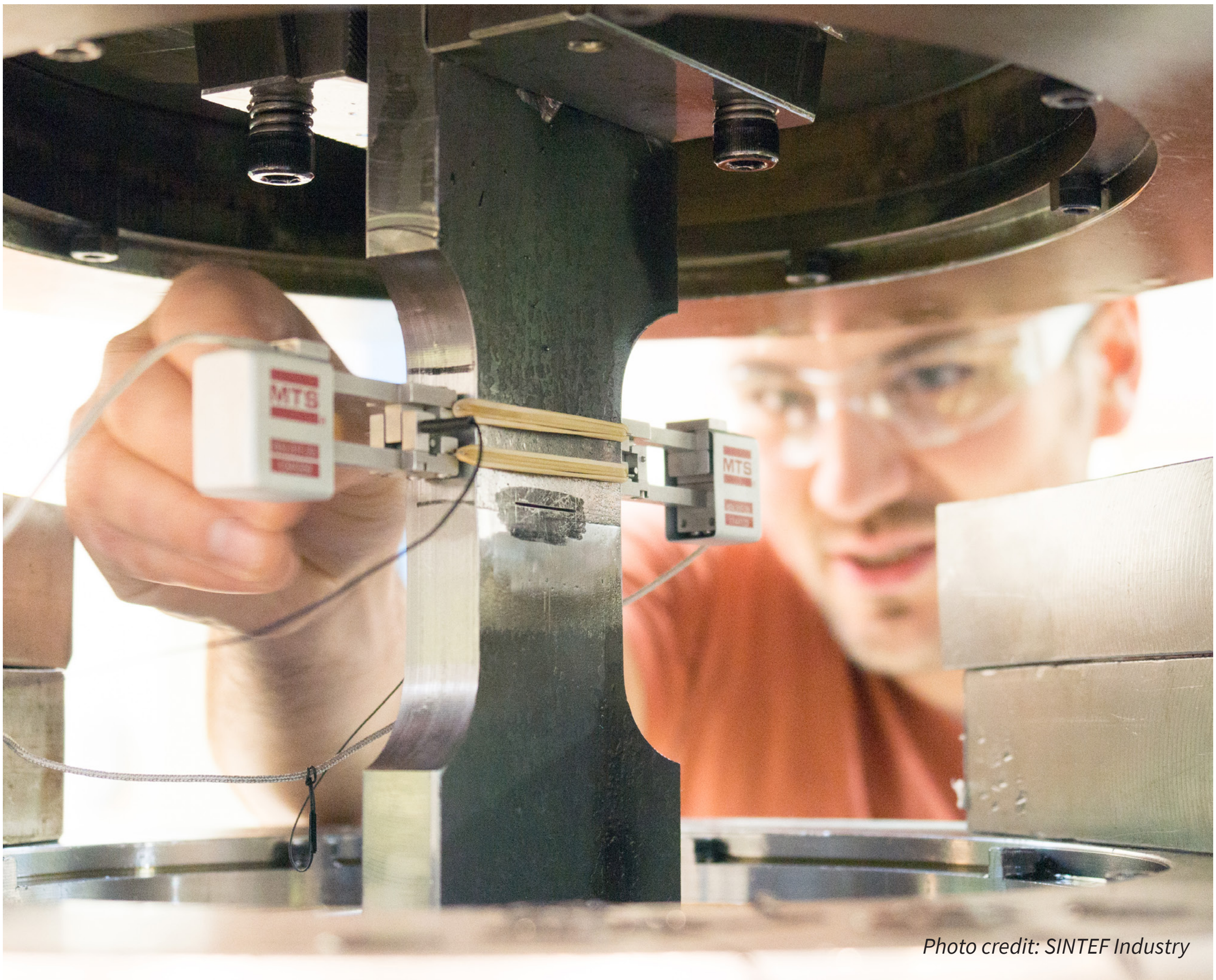


Photo credit: SINTEF Industry

WP7 Mooring and anchors

OBJECTIVE

The objective of this work package is to develop solutions to ensure that novel floating structures are kept at the location in a safe, sustainable and cost-efficient manner. This will be achieved by developing analysis tools and design methods, facilitating innovation and optimisation in the industry, and by developing guidelines and effective monitoring systems to improve the robustness of the mooring and anchor system.

MOTIVATION

The mooring and anchor solutions available today have been developed mainly for floating oil and gas structures. The novel floating structures considered in BLUES will bring new challenges to the mooring and anchor system, driven by the operating requirements of the structures, the load regimes generated by the novel structures themselves, the new environmental conditions for example near shore and in shallow water, and the need for cost optimisation of the structures. To meet these challenges, there is a need to improve fundamental physical understanding of the mechanism involved and to develop numerical tools for the industry to innovate and optimize both the complete structural system, as well as the individual structural components. The need for improved understanding of the physics is mainly linked to new operating conditions and more complex load regimes. Mooring line erosion around the anchors and multi-directional loading applied to shared anchors represent problems yet to be fully understood. Available integrated tools for floating structures are continuously improved, yet lack reliable models of anchors. Other, more dedicated numerical tools for analysing anchor installation and failure have the potential to support concept development of anchors, and partly substitute costly physical testing. Resilient infrastructure in the near-shore environment such as floating bridges, will be exposed to the risk of near-shore geohazards such as submarine slides and tsunamis. For these structures, reliable live monitoring of the anchoring system will improve the robustness throughout the lifetime. Firm strategies for anchor monitoring and remote evaluation of anchor integrity are currently missing.

Photo credit: Vryhof

Associated projects

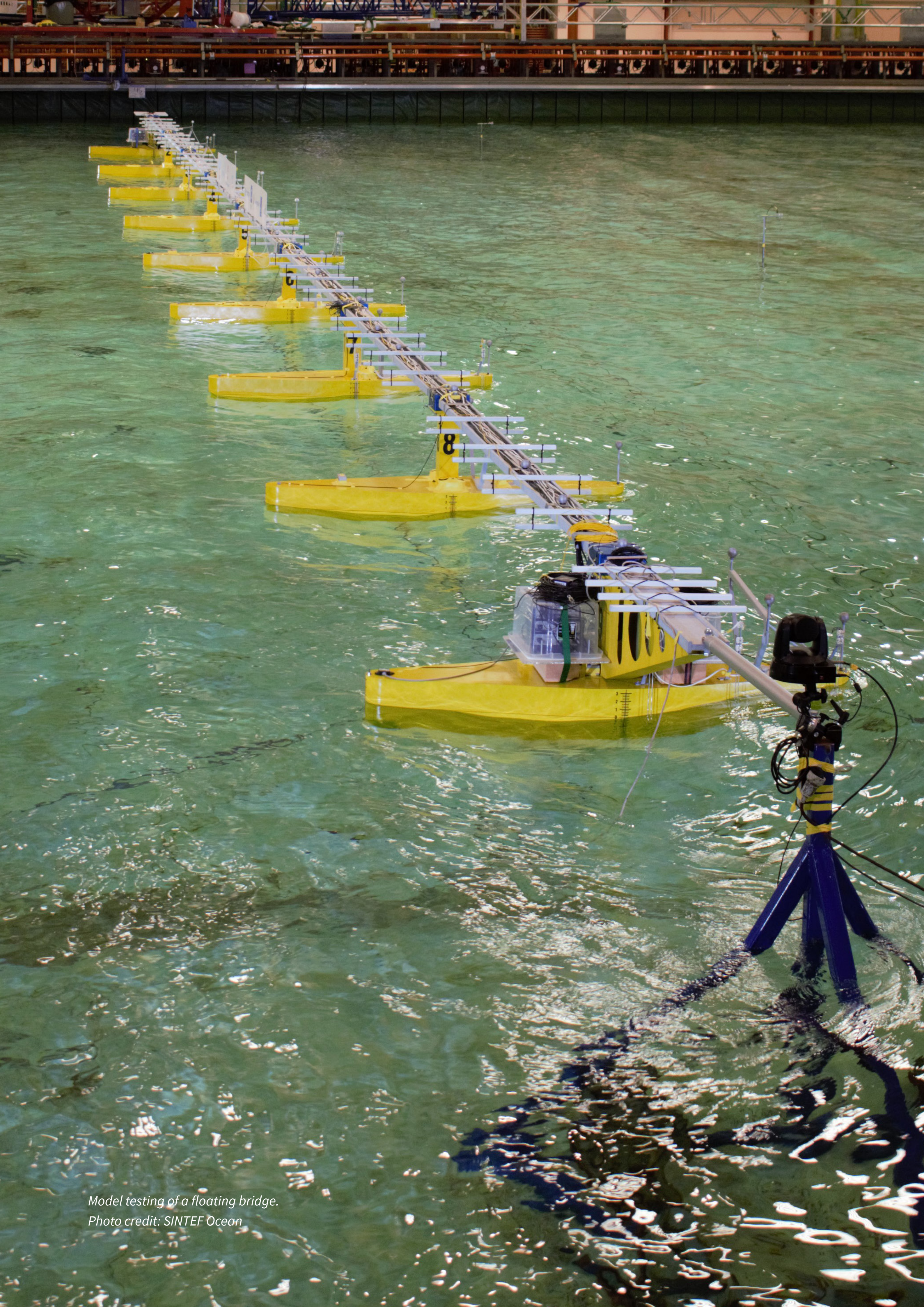
Project name	Duriation and funding source	Project lead	BLUES participants
ImproveFLOW - Improved Accuracy, Security and Efficiency for Floating Offshore Wind Analysis	2021-2023 IPN, RCN	DNV	SINTEF Ocean, Equinor
Mooring Optimization for Large Floating Wind Turbines	2020-2022 IPN, RCN	APL Norway	SINTEF Ocean
AluBridge - Robust Design and Efficient Production of Durable and Sustainable Aluminium Bridges	2020-2023 IPN, RCN	Hydro/Dr Techn Olav Olsen	SINTEF Industry
Upscale - Building knowledge on the future generation of floating substructures for very large wind turbines	2020-2023 KPN, RCN	IFE	NTNU, Dr Techn Olav Olsen, Equinor
WINDMOOR - Advanced Wave and Wind Load Models for Floating Wind Turbine Mooring System Design	2019-2023 KPN, RCN	SINTEF Ocean	Equinor, NTNU, APL Norway
SLADE - Fundamental Investigations of Violent Wave Actions and Impact Response	2019-2022 KPN, RCN	SINTEF Ocean	SINTEF Industry, Equinor, NTNU, Aker Solutions
RedWin2 - REDucing cost of offshore WINd by integrated structural and geotechnical design 2	2019-2021 IPN, RCN	Equinor	NGI, NTNU
LifeMoor - Improved Lifetime Estimation of Mooring Chains	2018-2022 KPN, RCN	SINTEF Industry	SINTEF Ocean, Equinor, NTNU
LFCS - Design and Verification of Large Floating Coastal Structures	2017-2021 KPN, RCN	SINTEF Ocean	NTNU, NPRA, Hydro

KPN *Knowledge-building Project for Industry*
IPN *Innovation Project for the Industrial Sector*

Related research centres

Centre name	Duriation	Funding source	Host
SFI Exposed Aquaculture Operations	2015-2023	SFI, RCN	SINTEF Ocean
SFI MOVE - Marine Operations Centre	2015-2023	SFI, RCN	NTNU
SFI CASA - Centre for Advanced Structural Analysis	2015-2023	SFI, RCN	NTNU
SFI Manufacturing - Sustainable Innovations for Automated Manufacturing of Multi-Material Products	2015-2023	SFI, RCN	SINTEF Manufacturing
SFI PhysMet - Centre for sustainable and competitive metallurgical and manufacturing industry	2015-2023	SFI, RCN	NTNU
NAPIC - NTNU Aluminium Product Innovation Center	2017-	Co-funded by NTNU & Hydro	NTNU
FME NorthWind - Norwegian Research Centre on Wind Energy	2021-2029	FME, RCN	SINTEF Energy
NTNU AMOS - Centre for Autonomous Marine Operations and Systems	2013-2022	SFF, RCN	NTNU

SFI *Centre for Research-based Innovation*
FME *Centre for Environment-friendly Energy Research*
SFF *Norwegian Centre of Excellence*

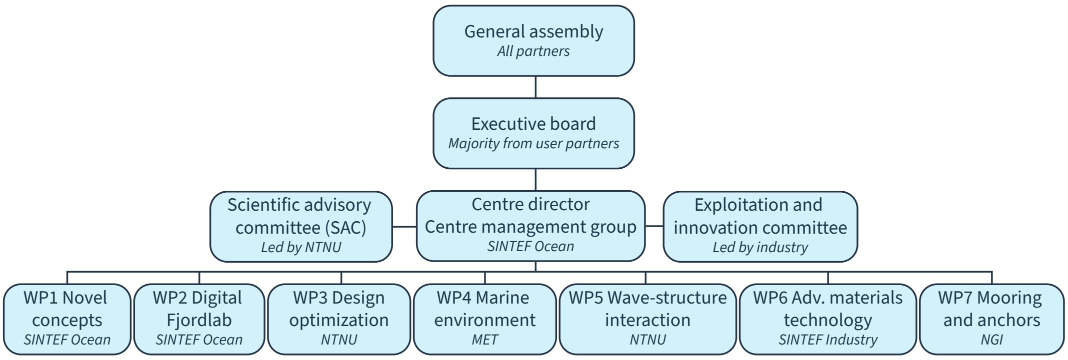


Model testing of a floating bridge.
Photo credit: SINTEF Ocean

Organization

Organizational structure

A consortium agreement governs the relationship between participants in SFI BLUES and regulates the organisation and the implementation, as well as the rights and obligations of the consortium participants. SINTEF Ocean is hosting SFI BLUES on behalf of the consortium. The ultimate decision-making body of SFI BLUES is the general assembly and consists of one representative of each partner. The board supervises the execution of the centre and consists of four representatives from the user partners and three representatives from the research partners. The centre director manages the daily operation of the centre together with a management group consisting of work package leaders. The centre director reports to the board.



Member of the board	Affiliation
Kjersti Bruserud (Chair)	Equinor
Mathias Egeland Eidem	Norwegian Public Roads Administration
Trond Furu	Hydro
Kolbjørn Høyland	Dr. Techn. Olav Olsen
Kristoffer Skjolden Skau	NGI
Bernt Johan Leira	NTNU
Arne Fredheim	SINTEF Ocean

Member of the centre management	Affiliation	Role
Vegard Aksnes	SINTEF Ocean	Centre director
Hagbart S. Alsos	SINTEF Ocean	WP1 manager
Babak Ommani	SINTEF Ocean	WP2 manager
Erin Bachynski	NTNU	WP3 manager
Birgitte R. Furevik	MET	WP4 manager
Trygve Kristiansen	NTNU	WP5 manager
Virgile Delhaye	SINTEF Industry	WP6 manager
Hans Petter Jostad	NGI	WP7 manager
Petter Andreas Berthelsen	SINTEF Ocean	Quality assurance

Research partners

SINTEF Ocean is the host institution for SFI BLUES. SINTEF Ocean is involved in all work packages and is responsible for *WP1 Novel concepts* and *WP2 Digital Fjordlab*. SINTEF Ocean contributes to SFI BLUES with expertise in marine hydrodynamics, marine structures and scientific software development.

NTNU Department of marine technology is involved in all work packages and responsible for *WP3 Design optimization* and *WP5 Wave-structure interaction*. NTNU will host most PhD students, post docs and master students. NTNU contributes to SFI BLUES with expertise in marine hydrodynamics and marine structures

The Norwegian Geotechnical Institute (NGI) is involved in work packages 1, 2, 3 and 4, and manages *WP7 Mooring and anchors*. NGI contributes to SFI BLUES with geotechnical expertise.

The Norwegian Meteorological Institute (MET) is involved in work packages 1 and 2 and manages *WP4 Marine environment*. MET contributes to SFI BLUES with metocean expertise.

SINTEF Industry is involved in work packages 1, 2 and 3, and manages *WP6 Advanced materials technology*. SINTEF Industry contributes to SFI BLUES with expertise in materials science.

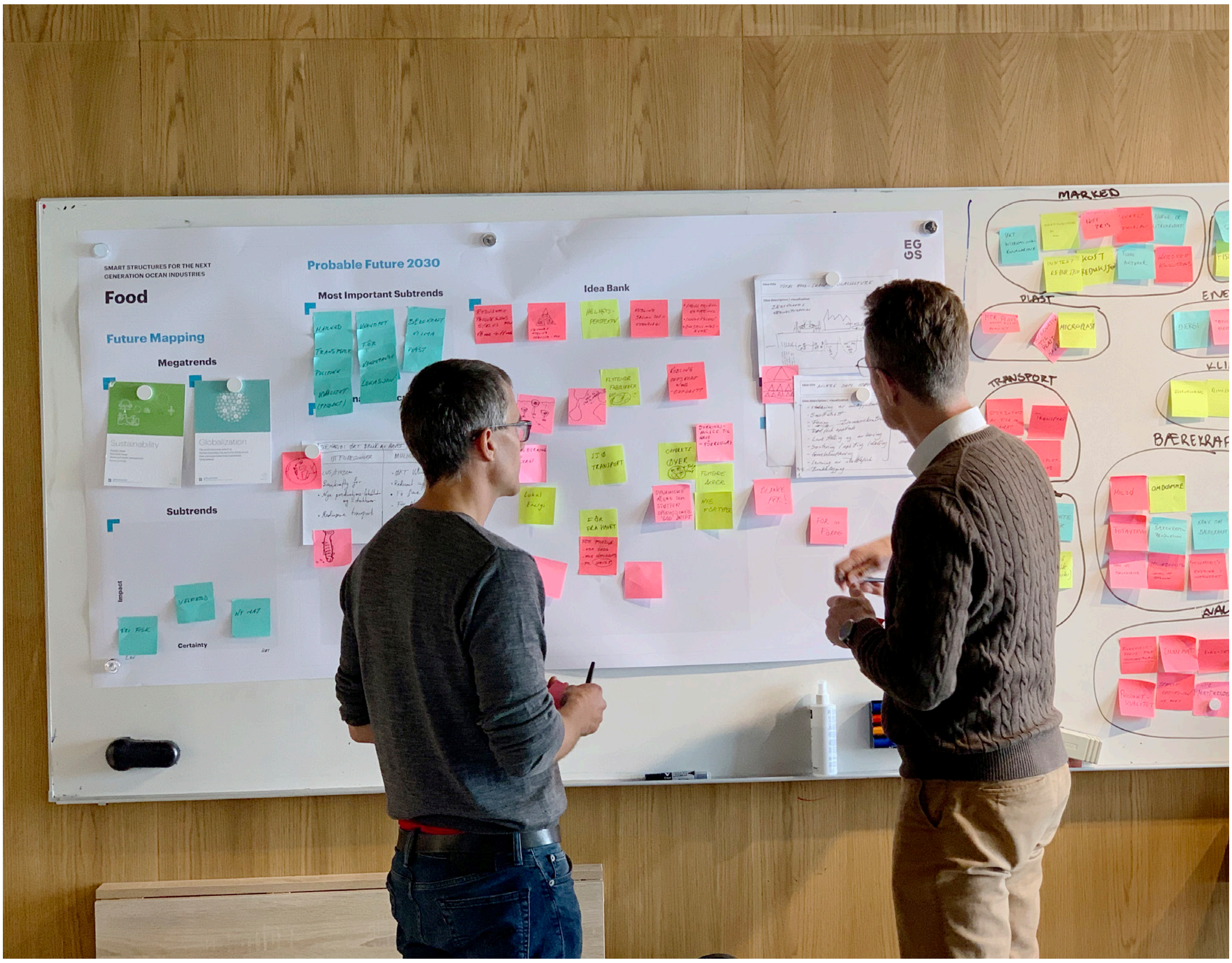
Ocean Space Centre, Trondheim, Norway. Photo credit: Snøhetta

User partners

Equinor	Role: End user/operator. Contribution: Floating wind and floating solar	equinor
Norwegian Public Roads Administration (NPRA)	Role: End user/operator Contribution: Floating bridges and submerged tunnels	Statens vegvesen
Dr. Techn. Olav Olsen	Role: Engineering consultants Contribution: Design and engineering expertise	DR. TECHN. OLAV OLSEN
Aker Solutions	Role: Engineering consultants Contribution: Design and engineering expertise with emphasis on floating wind and aquaculture.	AkerSolutions
Hydro	Role: Technology provider Contribution: Expertise on aluminium	Hydro
Ocean Sun	Role: Technology provider Contribution: Floating PV	Ocean Sun
Sevan SSP	Role: Engineering consultants Contribution: Design and engineering expertise	SEVAN SSP
DNV	Role: Classification society Contribution: Rules and regulations, engineering expertise, assurance and risk management, provider of digital solutions	DNV
APL Norway	Role: Technology provider Contribution: Expertise on mooring systems	APL NOV
Vryhof	Role: Technology provider Contribution: Expertise on anchor design	VRYHOF

Cooperation between the partners

The cooperation between the partners was initiated during the application development phase in 2019. A large number of one-to-one meetings with potential partners were used to present the initial idea of an SFI focusing on the marine structures of the future. Long-term industrial needs for research were explored and discussed through four all-day workshops on energy, infrastructure and food, facilitated by EGGS Design. The strong collaboration between the partners in the application phase was crucial for the successful evaluation of the application. This way of working will be continued when the research activities in the centre start in 2021. All partners were involved in the development of the annual plan for 2021, during the autumn 2020.



Research facilities

HYDRODYNAMIC LABORATORIES

The Ocean Basin Laboratory is used for basic as well as applied research on marine structures and operations. A total environmental simulation including wind, waves and current offers a unique possibility for testing of models in realistic conditions. With a depth of 10 metres and a water surface of 50x80m the Ocean Basin Laboratory is an excellent tool for the investigation of existing or future challenges within marine technology.

Several other hydrodynamic laboratories are available at SINTEF Ocean and NTNU, in addition to the Ocean Basin Laboratory:

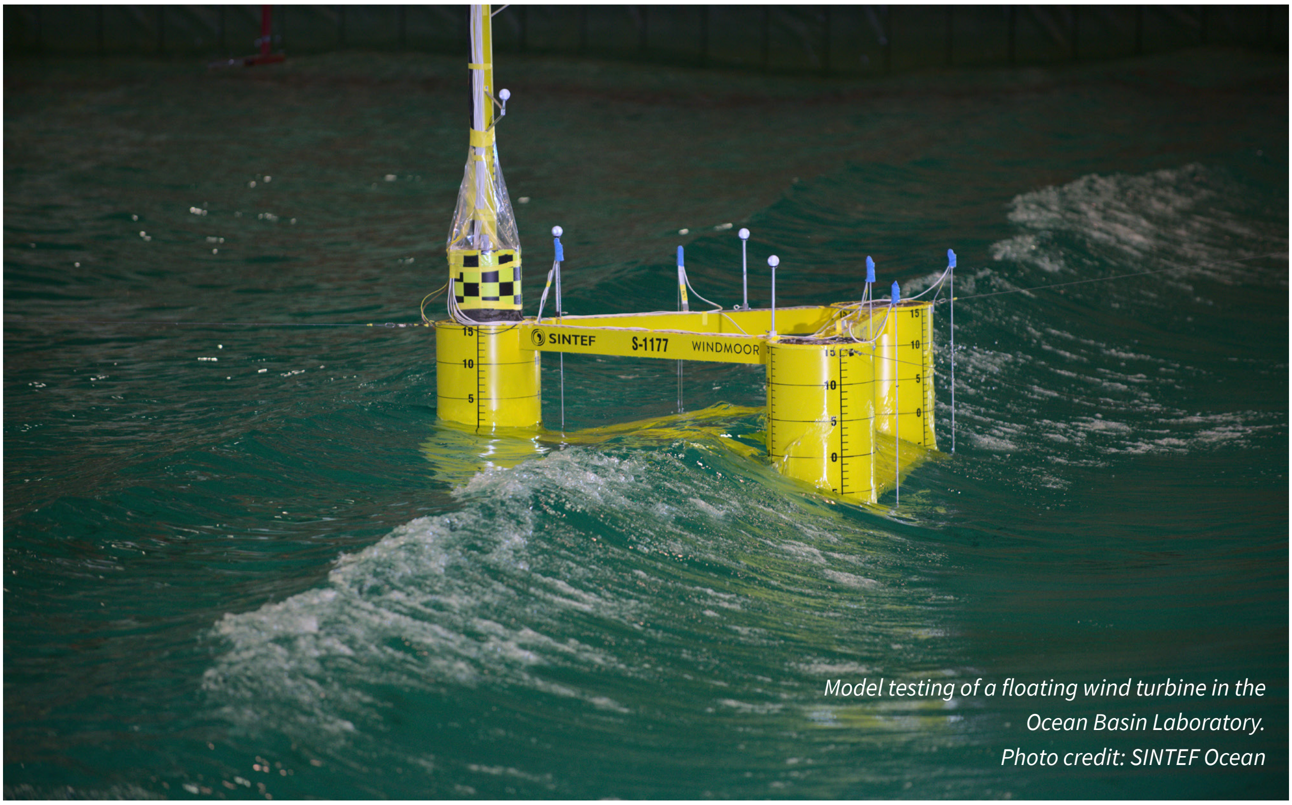
- Small and large towing tanks
- Circulating Water Tunnel
- Sloshing lab
- MC Lab
- Flume tank
- Cavitation tunnel

MARINE STRUCTURES LABORATORY

The marine structures laboratory at the Marine Technology Centre is run by SINTEF Ocean in collaboration with NTNU. The main activities in the laboratory are testing of structures, structural components and materials. Typical problems involve fatigue testing, ultimate strength and collapse testing. Experimental work is often combined with analytical or numerical analysis.

STRUCTURAL LABORATORY

SINTEF Industry's structural lab at Gløshaugen specialises in characterisation of materials and components for different loading scenarios. This includes function testing and load tolerance testing of components and products as well as fatigue- and fracture mechanics testing at different temperatures and environments. Reproducing real-life conditions allows for the investigation of how different materials and components hold when affected by fatigue and material defects. The structural lab also has access to special equipment from NTNU's structural engineering laboratory to reproduce a wide range of accidental and nonlinear loads, such as the pendulum kicking machine and drop tower.



Model testing of a floating wind turbine in the Ocean Basin Laboratory. Photo credit: SINTEF Ocean

Sulafjorden. Photo credit: Birgitte R. Furevik

POLYMER LABORATORY

SINTEF Industry's polymer laboratory specialises in the characterisation of polymeric and composite materials. It has tailored-made equipment for mechanical testing, long-term life cycle and ageing assessment of polymeric materials. The equipment enables us to reproduce the effect of external environment features during testing, such as temperature, chemical composition, and sun/rain. In addition, it is equipped with instruments to determine the characteristics of polymers such as molecular weight, rheological properties, chemical composition, and microstructure.

FJORDLAB

Fjordlab is the extension of Ocean Space Centre into the fjord and the ocean. Fjordlab will enable safe and efficient full scale fieldwork and experiments. This will be complement present research facilities, by making it possible to combine verifaction of numerical models in controlled laboratory environments with real conditions at sea. This will be important for realizing the ambition of performing world leading research within marine and maritime applications.

SULAFJORDEN MEASUREMENT CAMPAIGN

NPRA and MET have an ongoing collaboration on the measurements and the environmental modelling effort in connection with the coastal highway E39 in central Norway. MET is handling and distributing the atmospheric and oceanographic observations collected in Sulafjord, Vartdalsfjord, Julsund and Halsafjord on thredds.met.no. These observations form a full-scale laboratory which will be of great use in SFI BLUES.

GEOTECHNICAL LABORATORIES AND TEST SITES

NGI's laboratories in Oslo and Houston are two world-leading centers for geotechnical testing and interpretation. Geotechnicians and rock mechanical engineers require relevant data on ground conditions that describe the material behaviour of soil and rock types. The quality of laboratory testing of the strength and deformation properties of soil and rock types has given NGI's laboratory international acclaim. The R&D Program Norwegian Geo-Test Sites – NGTS, supported by The Research Council of Norway Infrastructure program, has established five national test sites. The test sites are located near Oslo and Trondheim and one on Svalbard. These test sites can be used to study new anchor concepts and verifying new design tools.

DIGITAL LABORATORIES

Digital laboratories are integrated into research and innovation work at all partners. Several partners develop and sell high end scientific software to engineering companies worldwide. Experimentation within a digital context will be crucial for the development of novel floating structures. A separate work package in SFI BLUES is dedicated to development of digital laboratory framework.

International cooperation

Cooperation with key international academic partners will include both researcher exchange and development of international research and innovation projects, for example seeking funding through EU's framework programme for research and innovation. SFI BLUES will strengthen existing cooperation with the following institutions:

- The Technical University of Denmark (DTU) - cooperation will build upon existing relations to researchers in the Dept. of Wind Energy and in the Dept. of Mechanical Engineering.
- Delft University of Technology (TU Delft) - cooperation through the European Wind Energy Master's Program, a joint MSc program with NTNU, TU Delft, DTU and U. Oldenburg.
- Blue Economy CRC - SINTEF Ocean and DNV are partners in the newly started Blue Economy Cooperative Research Centre in Australia https://blueeconomycrc.com.au/
- University of Western Australia (UWA) and Centre for Offshore Foundation Systems (COFS) - NGI has for a long period collaborated with UWA/COFS during physical testing of suction anchors and foundations in their centrifuge.

Scientific advisory committee

Name	Position	Affiliation	Main research area
Ken Takagi	Professor	University of Tokyo	Marine hydrodynamics
Sime Malenica	Head of section	Bureau Veritas	Marine hydrodynamics
Maurizio Collu	Associate professor	University of Strathclyde	Offshore renewable energy systems
Britta Bienen	Associate professor	University of Western Australia	Offshore geotechnics
Halvor Lie	Senior advisor	SINTEF Ocean	Marine structures
Trygve Kristiansen (Chair)	Professor	NTNU	Marine hydrodynamics

Blue Economy CRC site visit. Photo credit: Vegard Aksnes

Recruitment

SÉBASTIEN LAFLÈCHE IS THE FIRST PHD-STUDENT IN SFI BLUES

Sébastien Laflèche is the first PhD-student in SFI BLUES, starting January 1st, 2021. The working title of his PhD-thesis is *"Experimental and numerical methods for coastal waves"*. His research will be performed under WP4 Marine environment. Babak Ommani (SINTEF Ocean/NTNU) will be the main supervisor, while Trygve Kristiansen (NTNU) and Sébastien Fouques (SINTEF Ocean) will be co-supervisors. Sébastien Laflèche completed his MSc in 2020 at École Centrale Paris, with master thesis at SINTEF Ocean on the quality of wave generation in an ocean basin.

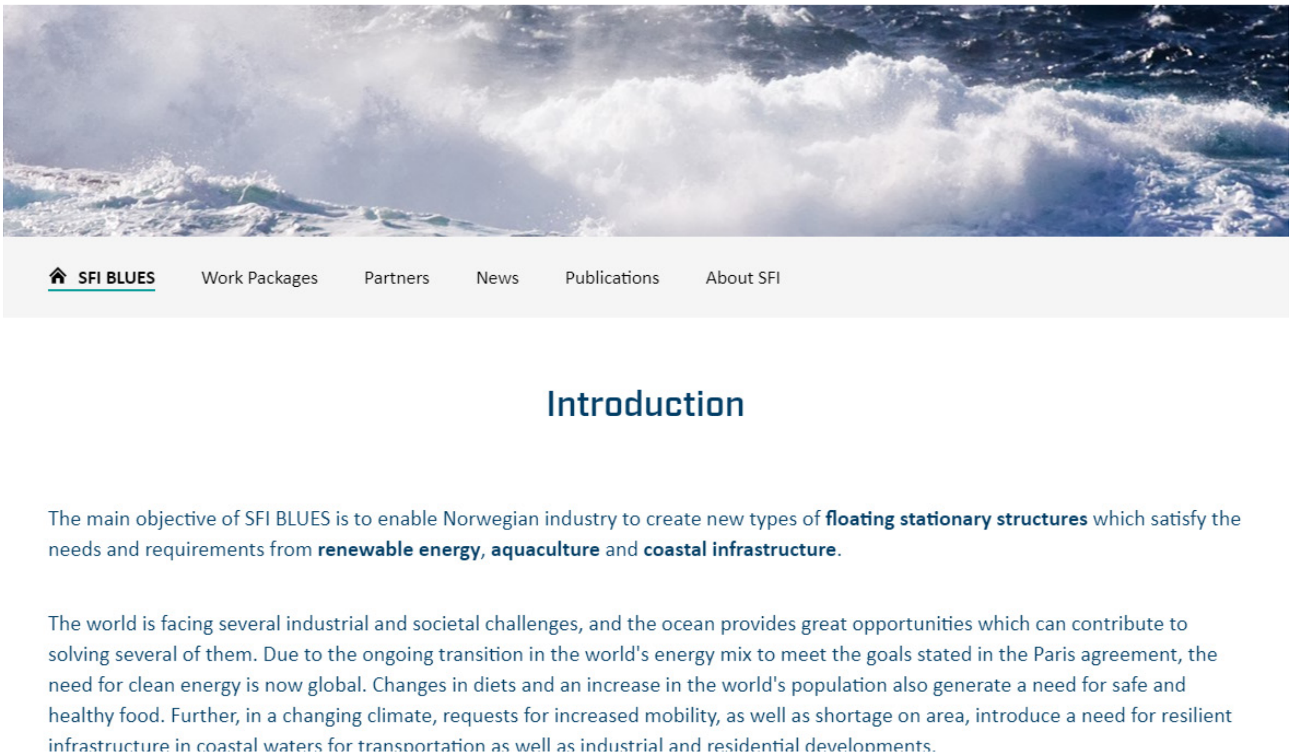
RECRUITMENT IN 2021

SFI BLUES will need expertise within all work packages. Recruitment of PhD-students and postdocs will continue in 2021. Two PhD-students will be recruited at NTNU, while MET and NGI will recruit one postdoc each. The centre's associated partner DTU will together with NTNU, hire a PhD in the beginning of 2021. This PhD will contribute to WP5. The centre will encourage exchange of PhD and post doc candidates with its international partners and associated partners.

Communication and dissemination activities

An overall communication plan for the centre will be established early 2021. SFI BLUES will actively communicate its activities and results to the stakeholders. Ensuring information flow, communication and to show the centre's development is an important administrative task for SFI BLUES. Digital platforms and media will be essential communication channels to achieve the centre's communication goals. Detailed communication action plans will be outlined each year based on the centre's communication and dissemination plan.

A web page has been established as the main communication channel for SFI BLUES. The web page is accessible from www.sfiblues.no and www.sfiblues.com. More information about SFI BLUES will be included on the web page during 2021. The SINTEF Ocean Facebook page (www.facebook.com/sintefocean) and LinkedIn profile (www.linkedin.com/company/sintefocean) will be used to promote news from the centre. Several partners of SFI BLUES are already using social media (LinkedIn, Facebook and Twitter), press releases and news items on their own web pages to promote their involvement in the centre.



Personnel

Key research scientists

Name	Affiliation	Main research area
Vegard Aksnes	SINTEF Ocean	Marine structures
Hagbart S. Alsos	SINTEF Ocean	Marine structures
Babak Ommani	SINTEF Ocean	Marine hydrodynamics
Maxime Thys	SINTEF Ocean	Marine hydrodynamics
Sebastien Fouques	SINTEF Ocean	Marine hydrodynamics
Sebastien Lafleche	SINTEF Ocean	Marine hydrodynamics
Senthuran Ravinthrakumar	SINTEF Ocean	Marine hydrodynamics
Håkon Ottar Nordhagen	SINTEF Ocean	Material and structural mechanics
Øyvind Ygre Rogne	SINTEF Ocean	Marine structures
Petter Andreas Berthelsen	SINTEF Ocean	Marine structures
Halvor Lie	SINTEF Ocean	Marine structures
Øyvind Hellan	SINTEF Ocean	Marine structures
Trygve Kristiansen	NTNU	Marine hydrodynamics
Erin Bachynski	NTNU	Marine structures
Josef Kiendl	NTNU	Structural mechanics
David Kristiansen	NTNU	Marine hydrodynamics
Zhen Gao	NTNU	Marine structures
Svein Sævik	NTNU	Marine structures
Birgitte R. Furevik	MET	Oceanography
Ole Johan Aarnes	MET	Oceanography
Kai Håkon Christensen	MET	Oceanography
Øyvind Breivik	MET	Oceanography
Hans Petter Jostad	NGI	Geotechnics
Nallathamby Sivasithamparam	NGI	Geotechnics
Haoyuan Liu	NGI	Geotechnics
Sarah Elkhatib	NGI	Geotechnics
Yusuke Suzuki	NGI	Geotechnics
Virgile Delhaye	SINTEF Industry	Material and structural mechanics
Afaf Saai	SINTEF Industry	Material and structural mechanics
Frode Grytten	SINTEF Industry	Polymer and composite materials
Gaute Gruben	SINTEF Industry	Material and structural mechanics
Stephane Dumoulin	SINTEF Industry	Material and structural mechanics
Hieu Hoang	SINTEF Industry	Material and structural mechanics

Photo credit: AMC Dissing + Weitling

PhD students funded by SFI BLUES

Name	Nationality	Sex (M/F)	Affiliation	WP	Period	Topic
Sebastien Lafleche	French	M	SINTEF Ocean/ NTNU	4	2021 - 2024	Experimental and numerical methods for coastal waves
NN			NTNU	3	2021 - 2024	Multidisciplinary design optimization of floating wind turbines
NN			NTNU	5	2021 - 2024	Membranes in waves - experimental, theoretical and numerical modelling

Postdocs funded by SFI BLUES

Name	Nationality	Sex (M/F)	Affiliation	WP	Period	Topic
Jan-Victor Björkqvist	Finnish	M	MET	4	2021 - 2023	Wave modelling on unstructured grids
NN			NGI	7	2021 - 2023	Numerical modelling of cyclic behaviour of soil - anchor interaction

PhD students associated with SFI BLUES, funded by other sources

Name	Nationality	Sex (M/F)	Affiliation	WP	Period	Topic
NN	-	-	DTU/NTNU	5	2021 - 2024	Hydrodynamic modelling of floating seaweed farms

Master students

No master students in 2020.

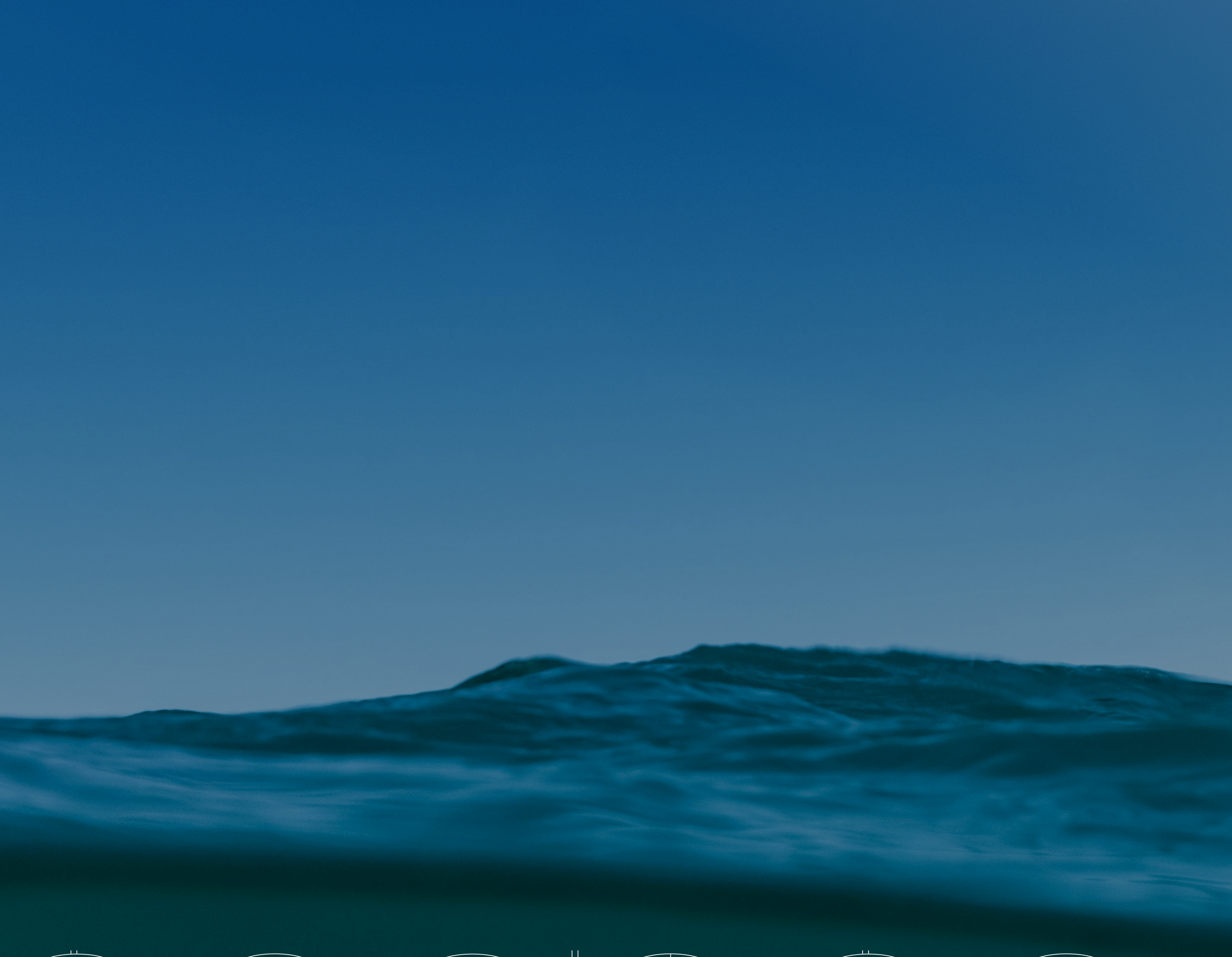
Statement of accounts 2020

	Funding	Cost
The Research Council	465	-
The Host Institution (SINTEF Ocean)	-	503
Research Partners*	-	-
Industry Partners**	-	-
Public Partners***	38	-
Equipment	-	-
Total	503	503

(All figures in 1000 NOK)

* NTNU, NGI, MET, SINTEF Industry
** Equinor, Hydro, Dr Techn Olav Olsen, Aker Solutions, DNV, APL Norway, Sevan SSP, Ocean Sun, Vryhof
*** The Norwegian Public Roads Administration


Photo credit: OO-Star Wind Floater (Floating Wind Solutions AS)



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