



Selected Work Packages for Blue INNOship

In focusing the Blue INNO+ partnership (the Blue INNOship) the following Work Packages (WP) in the framework has been selected:

- WP 1 – Technical Solutions for Ship Design and Operation
- WP2 – Ship Operations and Performance Management
- WP3 – Retrofit of Products and Systems
- WP4 – Lifecycle Modeling and Monitoring of Ships and Products

Projects for Blue INNOship shall be defined in these Work Packages during June 2014. Each project must include at least one of the Key Partners. To suggest a project please use the specific form “Blue INNOship project_Key Partner and Project name.doc” and send it for initial review to Rikke@blaaainno.dk.

Detail of what topics are covered in the Work Packages is found in the following. Dissemination is an integral part of all WP and not specified here.

WP1 – Technical Solutions for Ship Design and Operation

Scope is to develop technical solutions to meet the goal of reduced energy consumption, ship emissions and noise. The developed solutions can be physical as well as virtual.

Sub-Work Packages are:

- WP1.1 Development of technologies for reduced energy consumption, energy efficient ship design, and simulation and modeling
- WP1.2 Development of technologies for reducing SO_x, NO_x, noise, etc.
- WP1.3 Use and development of alternative marine fuels
- WP1.4 Alternative propulsions for ships
- WP1.5 Development and use of lightweight materials for ships

WP1.1 Development of technologies for reduced energy consumption, energy efficient ship design, and simulation and modeling:

Development of technologies for reduced energy consumption, energy efficient ship design, and simulation and modeling of the ship, the technical solutions and their interactions.

Topics for projects *might* include:

- Design and optimization of propellers, rudders, bulbs, ducs, hulls, air cavity systems, antifouling paints, etc.
- Optimization and upgrade of machinery systems, waste heat recovery systems and auxiliary machinery systems including numerical simulations of machinery.
- Etc.

WP1.2 Development of technologies for reducing SO_x, NO_x, noise, etc.

Development of technologies for reducing SO_x, NO_x, noise, and possibly other emissions from ships, that cannot be reached purely by lowering fuel consumptions.

Topics for projects *might* include:

- Development of exhaust gas technologies for reducing SO_x (scrubbers)
- Development of technologies for reducing NO_x (catalysts, exhaust gas recirculation, etc.)



- Development of exhaust gas technologies for reducing particles and black carbon (filters and catalysts)
- Development of ballast water treatment technologies
- Reduction of propeller noise (primarily cavitation)
- Bio-fouling

WP1.3 Use and development of alternative marine fuels, fx to reach 100% reduction in CO₂ emission

Use and development of alternative marine fuel types. For non-fossil possibly demonstrate 100% CO₂ reduction.

Topics for projects *might* include:

- Use of very low sulphur fuels in existing engines (lubrication properties, etc.)
- Use of gas in combustion engines (LNG, methane slip, energy efficiency of gas engines, injection pressure, combustion process, etc)
- Use of methanol or other alcohol-based fuels in ships
- Development of new marine fuel types as e.g. biofuels and biogas

WP1.4 Alternative propulsions for ships

Development of possible propulsion solutions with sustainable energy sources.

Topics for projects *might* include:

- Hybrid and pure battery propulsion, development of batteries and charging solutions suitable for marine use.
- Fuel cells
- Solar power
- Wind power

WP1.5 Development and use of lightweight materials for ships

Development and use of lightweight materials for ship construction to lower structure weight and fuel consumption.

Topics for projects *might* include:

- Materials (composite and hybrid material constructions)
- Joining properties of lightweight materials
- Fire properties and safety issue
- Crashworthiness and ice-strengthening of composite vessels
- Scrapping and environmental impact of composite materials

WP2 – Ship Operation and Performance Management

Scope is to develop a monitoring tool to provide a complete operational overview of ship performance, fuel savings, reduced emissions, decision real-time support with dashboard tracking and reliable, clear reports. Considering human and organizational aspects, competences and impact.

Sub-Work Packages are:

- WP2.1 Performance monitoring and data analyses
- WP2.2 Operation Analysis
- WP2.3 Online real-time onboard vessel decision support tool



- WP2.4 Documentation
- WP2.5 Energy efficiency awareness – Crew and office involvement

WP2.1 Performance monitoring and data analyses

Topics for projects or part-projects *might* include:

- Data sources, sensors, sampling, and transmission
- Data analysis, fault detection, redundancy, robust design, uncertainty estimates, minimum required data set, wave climate estimate

WP2.2 Operation Analysis

Topics for projects or part-projects *might* include:

- Vessel performance optimization fuels and emissions.
- Optimization of vessel operation profile – flexible operations (working vessels or ferries)
- Different propulsion types and methods – optimization of e.g. hybrid propulsion

WP2.3 Online real-time onboard vessel decision support tool

Topics for projects or part-projects *might* include:

- The operational parameters as e.g. speed, trim, ballast, stowage, lashing, stabilities, waves
- The competences and experiences of the crew
- Safety in regards of adverse weather conditions

WP2.4 Documentation

Topics for projects or part-projects *might* include:

- Monitoring and tracking of ship and fleet performance as well as documentation of continuous improvements initiated and planned (SEEMP, MRV, owner, charter)
- Etc.

WP2.5 Energy efficiency awareness – Crew and office involvement

Topics for projects or part-projects *might* include:

- Awareness throughout the organization – implementation of performance culture onboard and equivalent onshore
- Cooperation and communication – performance department and crew
- Consider parameters as human factors, education, competences, experience and organizational incentives
- System for collecting and sharing knowledge, incorporating the operational knowledge of the crew into systems and plans
- Training and education, simulation, self-evaluation, feedback mechanism



WP3 – Retrofit of Products and Systems

Scope is to bridge the gap between current knowledge and competences to effective selection and implementation of retrofit solutions.

Developing a test mechanism starting with desktop studies, providing structure and guidelines to enable effective and safe real life tests onboard.

Sub-Work Packages are:

- WP3.1 Technology mapping and development, and emission estimates of technologies
- WP3.2 Standard and methods for verification and evaluation of retrofit solutions
- WP3.3 Decision support tools and formulation of decision platform

WP3.1 Technology mapping and development, and emission estimates of technologies

Technology mapping and development, and emission estimates of technologies (incl. new development in this project)

Topics for projects or part-projects *might* include:

- Mapping of the current industry capabilities (and shortcomings)
- Identification of groups of offerings and technologies with similar traits
- Specification of the parameters against which these retrofit solutions should be evaluated

WP3.2 Standard and methods for verification and evaluation of retrofit solutions

Defining standard and methods for verification and evaluation of retrofit solutions

Topics for projects or part-projects *might* include:

- Analysis of the current approach to choosing solutions, understanding/describing value creating
- Formulation of common “language” for describing and evaluating retrofit solutions
- Bundling of retrofit solutions, system approach, extending existing solutions to better market fit of requirements

WP3.3 Decision support tools and formulation of decision platform

Decision support tools and formulation of decision platform through desktop and real-life test mechanism

Topics for projects or part-projects *might* include:

- Clarification of the organizational concerns and requirements for decision making
- Integration of findings and formulation of decision platform, including process through desktop evaluation to onboard test
- Structure and guidelines to prepare for and enable effective and safe real life tests onboard



WP4 – Lifecycle Modeling and Monitoring of Ships and Products

Scope is to provide an empirically based, consistent and sound life cycle model with mechanisms to highlight operational characteristics driving system costs, and how both technological changes and human actions impact.

Sub-Work Packages are:

- WP4.1 Development of consistent and robust model for describing lifecycle of vessel and vessel subsystems
- WP4.2 Development of features for quantification of value and impact of existing and future product/service systems
- WP4.3 Testing of model using operational data and known product/service system solutions

WP4.1 Development of consistent and robust model for describing lifecycle of vessel and vessel subsystems

Topics for projects or part-projects *might* include:

- Inclusion of heterogeneous components (flow, assets, human resources, etc.)
- Facilities for dynamically populating model using real-world data
- Test of sub-system models

WP4.2 Development of features for quantification of value and impact of existing and future product/service systems

Topics for projects or part-projects *might* include:

- Total cost of ownership
- Life cycle environment assessment
- Life cycle costing from a societal perspective
- Economic assessment of ship emission abatement strategies

WP4.3 Testing of model using operational data and known product/service system solutions

Topics for projects or part-projects *might* include:

- Establishing life cycle database
- Simulation of model dynamics
- Data mining for life cycle analysis (mapping of data sources, standard for data mining and data analysis)
- Cost-benefit analysis of realized green solutions