

WP2 - Multi-layer digital platform development and implementation

D2.4: Digital twins for use cases : Solstad - Public Summary:

The ambition of the NEMOSHIP project is to develop, test and demonstrate innovative technologies, methodologies and guidelines to accelerate large BESS deployment and optimal exploitation toward 2030 on both hybrid and fully electric configurations. To help achieve this ambition, NEMOSHIP will develop a 1 MWh modular and standardised battery energy storage solution that is able to exploit heterogeneous storage units and a cloud-based digital platform to enable data-driven, optimised and safe exploitation. The project will demonstrate the maturity of these innovations at TRL 7 for hybrid ships as well as their adaptability towards fully electric ships.

The present deliverable is part of WP2/Task 2.4 which focuses on the NEMOSHIP digital platform development and implementation. This WP includes the development of digital twins for each of the NEMOSHIP use cases, namely an offshore vessel from Solstad, a cruise vessel from Ponant and two semi-virtual full electric use cases. Simulation in the context of the NEMOSHIP project involves the creation of detailed, dynamic models that replicate the behavior of vessel energy systems under various conditions. These simulations are essential for predicting performance, identifying potential issues, and optimizing operations without the risks and costs associated with physical testing.

By involving advanced simulation tools and techniques, the digital twin can emulate the complexities of hybrid ship configurations, including aspects such as energy storage, distribution, and consumption.

This document describes the digital twin modelling for the NEMOSHIP use case linked to the demonstrator from Solstad, i.e. Normand Drott vessel, which is an anchor handling tug supply. The reference digital twin model development uses models from the Simcenter Amesim marine library from partner Siemens Digital Industry Software (SISW), fed with relevant data for system validation and optimisation. Specific models for the Battery Energy Storage System (BESS), including power electronics converters and high energy (HE)/high power (HP) batteries, have been developed.

These models are integrated with Field Mock-up Units (FMU) into the Simcenter Amesim simulation for a modular battery energy storage system concept Digital Twin model. These models will also be used for testing and tuning the control algorithms in WP4 and



tested and validated through the demonstrations and replicability use cases in WP5, WP6 and WP7.

First, an overview of the vessel considered in the use case is provided, including the description of data available. Then, the methodology for digital twin modelling is described, with the different steps followed specifically for the Solstad use case, including validation results. The different parts of the BESS model are then described. Their integration into the full ship modelling for the modular BESS digital twin model with validation is presented in the last section.