



GAMMA
TECHNOLOGIES



MARINE SOLUTIONS

GT-SUITE: Holistic Simulation Platform
Simplifying Complex Decisions for a Carbon
Neutral Future

Simulations Solutions for the Future of the Marine Industry

The path to decarbonization of the marine industry relies on the successful implementation a mix of versatile technologies by manufacturers.

Each marine vessel has unique challenges. Starting with the ship type and its operating profile to the choice of the fuel type and auxiliary systems (fuel cells, batteries, power converters and carbon capture systems), engineers must plan for a myriad of combinations. As each propulsion technology brings its own benefits and risks, the overall system needs to be designed and evaluated using reliable and predictive tools.

For these reasons, system simulation is key to minimize those risks by optimizing the system design and support operations with digital solutions.

Gamma Technologies develops GT-SUITE, an industry-leading model-based systems engineering (MBSE) platform. By utilizing GT-SUITE's libraries, accurate models can be built of any marine system, such as propulsion and power supply, combustion, emissions and exhaust aftertreatment, electrical energy storage and power conversion. With GT-SUITE, accurate virtual testing of design combinations can provide key insights and feedback on performance long before a physical model is built.

This makes GT-SUITE the ideal trusted partner for the decarbonization journey of the marine sector.

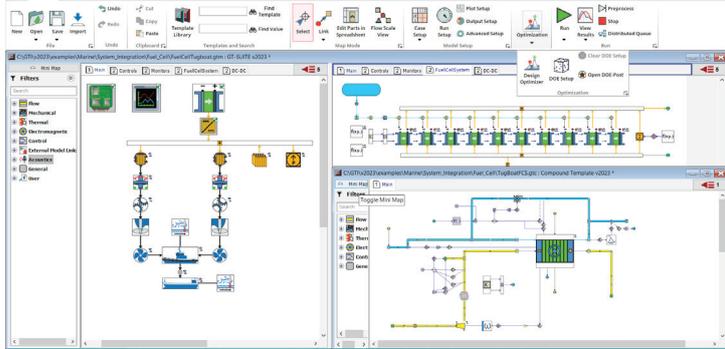


Physics-based Modeling as a Backbone for Marine Digital Twins

Flexible fuels - Engine manufacturers are looking at new fuels such as ammonia, methanol and hydrogen as primary or secondary energy carriers for dual fuel operation. This requires the holistic optimization of the combustion, emission formation and the aftertreatment processes to mitigate any harmful emissions. GT-SUITE provides world-class leading integrated solutions for complex systems and applications from concept design phase to the digital twin of the marine vessel.



Fuel Cell and Balance of Plant (BOP) - Fuel cell OEMs are offering their products to the marine industry, while the tailored design of the BOP and the hydrogen storage remains the crucial task for the integrator to ensure the efficiency and safety of the marine fuel cell system. GT-SUITE provides the world-class leading integrated solution for the optimization of the fuel cell / BOP and hydrogen storage design and leverages the selection and matching of subsystems and components.



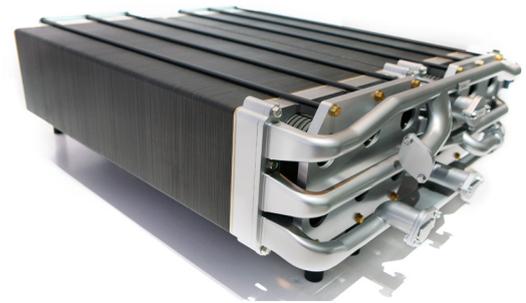
GT-SUITE | Fuel Cell Electric Tugboat Model Setup

How GT-SUITE's System Simulation can help:

- Develop safe and efficient energy storage systems
- Explore alternative fuels for lower GHG footprint
- Identify the best propulsion topology per fleet application
- Maximize GHG emission savings with optimal energy management
- Continuous MBSE platform from concept finding stage to operation



Energy Storage System (ESS) - Stringent regulations are evolving to allow alternative safety designs. This will increase competition and leverage the adoption and integration of ESS technologies. Marine systems highly benefit from the integration of ESS into the propulsion and energy supply system due to the multitude of additional operating modes. With a focus on operational safety, GT provides the industry leading battery simulation solution to predict performance, degradation and thermal runaway.



Energy Management - The integration of novel technologies necessitates the understanding of the energy paths within the ship system and the optimization of the energy management to exploit the full greenhouse gas (GHG) saving potential. With GT-SUITE, it is easy to integrate all marine subsystems into a single virtual ship model and explore its GHG saving potential based on dynamic maneuvers and optimal control strategy solutions.

Web-based Access - Gamma Technologies offers GT-Play, a next generation web application platform for model-based engineering

Key Takeaways:

- Model-based Digital Twin for component and system health monitoring
- Topology optimization driven by digitization
- Online controls optimization for minimal operating costs

Scan the QR code to learn more about GT's marine simulation solutions

