

LIGHT STRUCTURES

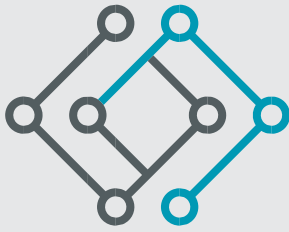
Passion for Monitoring



Navy & Coast Guard

SENSFIB NAVY, SENSFIB FPSO, SENSFIB
GLOBAL FORCES, and HEALTH
MONITORING

Achieve Reliability through Knowledge



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SENSFIB™ NAVY

Navy Vessels often operate in open seas with severe wave and weather conditions. Navy vessels are also operated at high speed in semi-displacement condition. The severe effects of wave impact and whipping response on the fatigue life and ultimate strength is important to measure and handle.

The monitoring-data can be presented in real-time as an advisory system to the operator. The data is stored, and post-operation analysis can be performed to have full control on the status of the hull.

SENSFIB™ NAVY are being more frequently used for patrol boats to monitor fatigue damage accumulation and maximum load statistics to make informed decisions for life cycle maintenance of the boats hull.

SENSFIB™ NAVY will enable review and evaluation of operational location and possible rotations to manage fatigue damage accumulation.

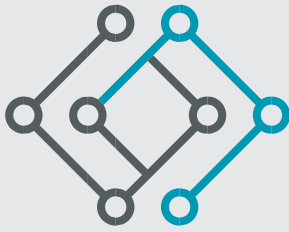
The use of onboard monitoring is a proactive approach towards lifecycle maintenance and reduces the need to replace structure during the service life. It also offers potential to extend the service life of the patrol boats, and thereby reduce the lifecycle costs significantly.

Navy and Coast Guards are increasingly pursuing a hull structure monitoring system for lifecycle maintenance on their patrol boats/semi-displacement vessels.



Naval Hull Structural Stress Monitoring Operational Control

- Reduced maintenance cost
- Dynamic operator guidance
- No annual recalibration
- Analysis
- Fiber optic technology



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SENSFIB™ FPSO & OFFSHORE

Safe and cost-effective operation of hulls is key in today's offshore oil and gas market. With SENSFIB™ HULL for FPSO, the operator gains valuable knowledge of the hull's condition. This supports maintenance planning, and life extension decision, and eases the inspection work. SENSFIB™ HULL provides real-time data for operative decisions and the saving of lifetime hull loads with environmental parameters for onshore postprocessing.

SENSFIB™ HULL monitors the stress responses and accelerations during operation to provide online information about load margins and long-term information about fatigue accumulation. The scope and layout of the system can be adapted to fit any hull or geographical location. Fatigue hotspots such as midships side shell structures, hull-topsides interface, and other details of interest will also be taken into consideration.

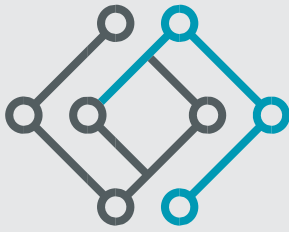
The Fiber Bragg Grating (FBG) optical sensing technology gives SENSFIB™ a competitive edge compared to conventional strain gauge technology as the fiber optic technology provides a higher level of accuracy, no annual/biannual recalibration costs, and lower maintenance cost with less intervention.

SENSFIB™ HULL for FPSO can also be extended with a Mooring Tension Monitoring viewer to track FPSO offsets and mooring line tension, including alarm function.



Hull and Structural Monitoring Operational Control

- Reduced maintenance cost
- Dynamic operator safety guidance
- Extended hull life-cycle
- Fiber optic technology
- Approved by leading classification societies
- Attractive ROI



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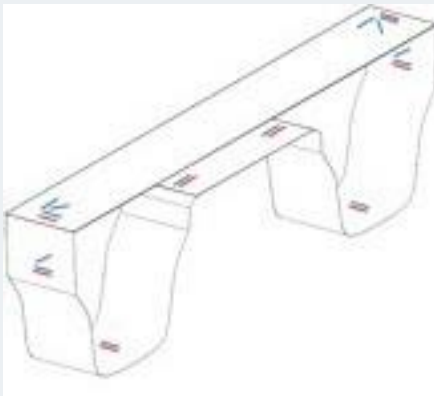
SENSFIB™ GLOBAL FORCES

For complex structures such as semi-submersibles and catamarans, Light Structures offer the unique SENSFIB™ GLOBAL FORCES system. Based on the same high-performance fiber optic monitoring solutions as SENSFIB™ NAVY and SENSFIB™ ICE, the SENSFIB™ GLOBAL FORCES package utilizes Finite Element analysis to move from localized strains and stress to the global moments and forces acting on the hull.

With the powerful data processing that is the core of the SENSFIB™ GLOBAL FORCES, system owners and naval architects have the opportunity to understand the behavior of complex structures during interaction with wind and wave patterns and compare actual loads on the structure directly with the limiting design loads.

Hard to grasp loads such as torsion and twisting are made available in real-time to the user, and warning thresholds can be set. Virtual sensors can be configured to monitor the actual stress from real-life combinations of forces and moments that are not easily modeled.

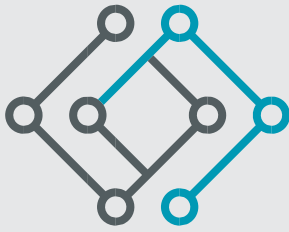
SENSFIB™ GLOBAL FORCES can be combined with other SENSFIB™ systems such as SENSFIB™ HULL, IMMS for SENSFIB™ or SENSFIB™ COMFORT.



Global monitoring

- Vertical bending moment
- Horizontal bending moment
- Torsion moment
- Vertical shear forces
- Horizontal shear forces
- Normal compressive force





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STRUCTURAL HEALTH MONITORING

According to 'Structural Health Management in the NAVY, Navy systems are designed such that their structures if properly maintained, will not experience structural damage (defined as crack initiation) for the design life of the system.

Structural Health Monitoring solutions are essential to meeting the design criteria as they ensure that large Naval maintenance organizations can leverage the efficiencies of Condition Based Maintenance, which include the ability to reduce vessel downtime and associated costs, while ensuring fleet readiness. Further, monitoring data can be presented in real-time as an advisory system to the operator, supporting vessel safety in everyday operations.

"Ignacio Perez: Office of Naval Research, Arlington | Michael! DiUlio: Naval Sea Systems Command, Washington | Scott Maley & Nam Phan: Naval Air Systems Command, Patuxent River"

SENSFIB™ Navy, Ice and Global Forces are our most used Naval systems, however, Light Structures works with navies globally to customize solutions to the exact needs of their vessels and fleet.

Secure fleet readiness and asset availability with precise measurements

Light Structures and our SENSFIB™ structural health monitoring enables you to:



Acquire precise structural stress data and fatigue data.

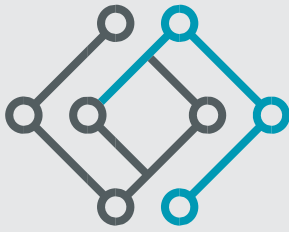


Analyze acquired data & deliver to any digital platforms.



Optimize condition-based monitoring & inspections.



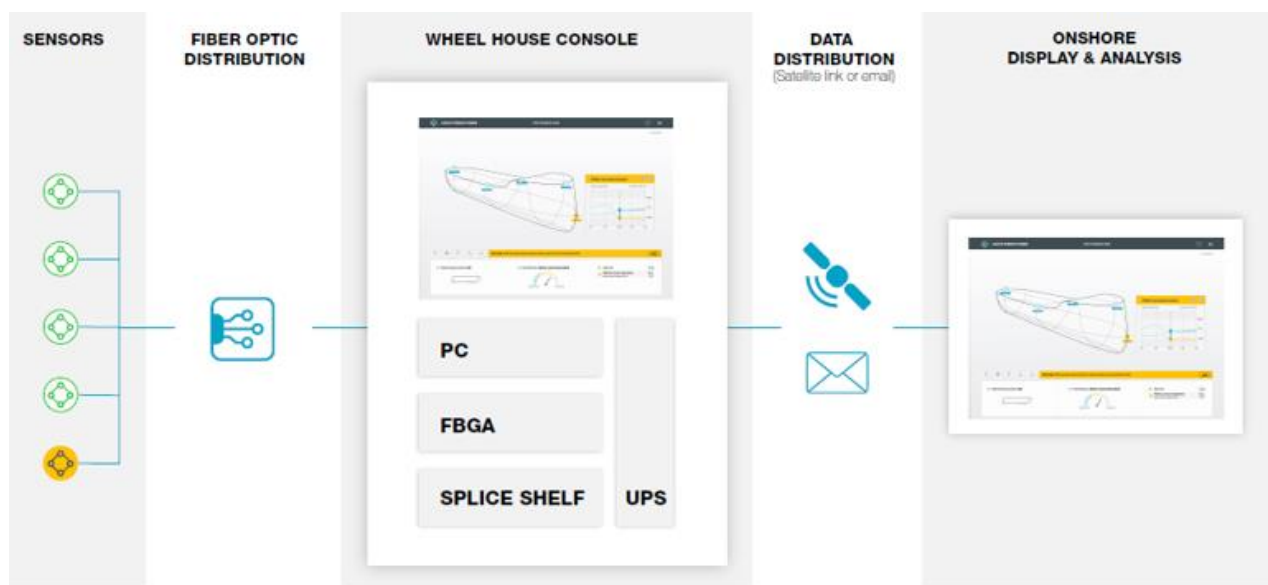


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SENSFIB™

Light Structures is the world-leading supplier of fiber optic condition monitoring systems based on Fiber Bragg Grating technology (FBG). Our patented SENSFIB™ range includes Hull Stress Monitoring, Ice Load Monitoring, Sloshing Monitoring, FPSO, and Semi subs Monitoring with our customized Hull Info software.



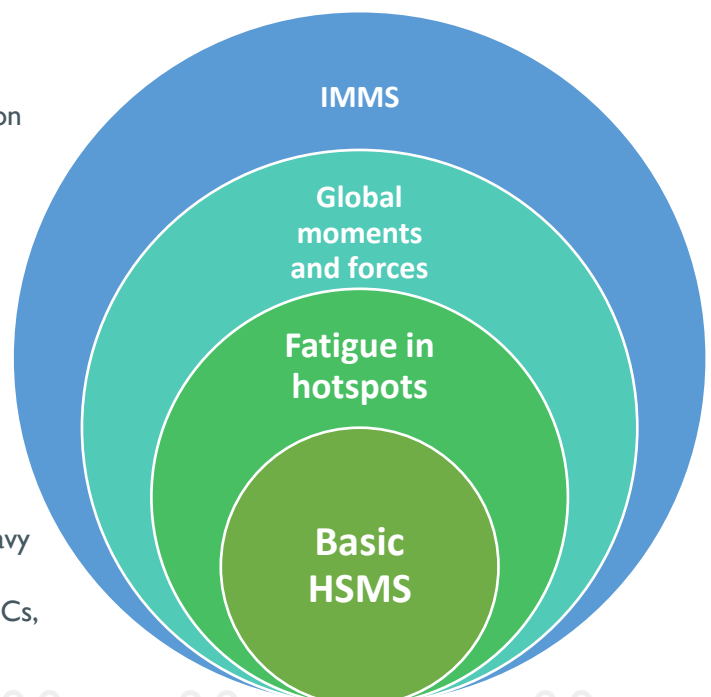
System complexity levels

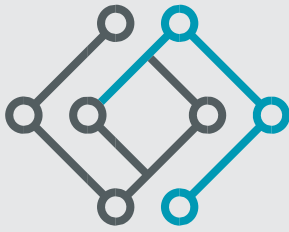
Systems can be configured for a range of application levels.

Number of sensors and level of data processing is determined from:

- The **complexity** of the structure
- The operating **environment**
- The customer's **goals** for monitoring

Current **SENSFIB™** system installations include navy and coast guard vessels, large container and RoRo vessels, bulk carriers, shuttle tankers, FPSOs, VLCCs, LNGCs, and floaters in the offshore segment.



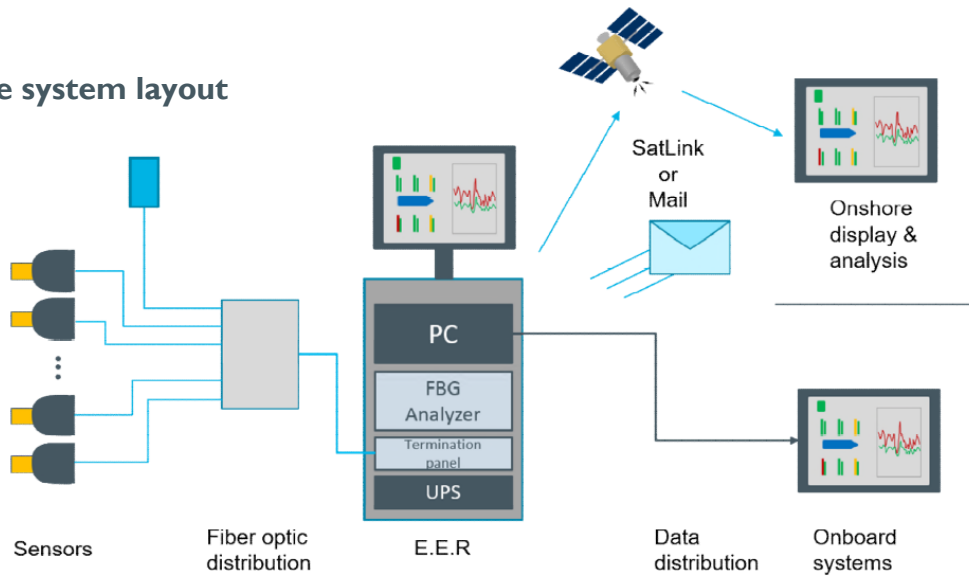


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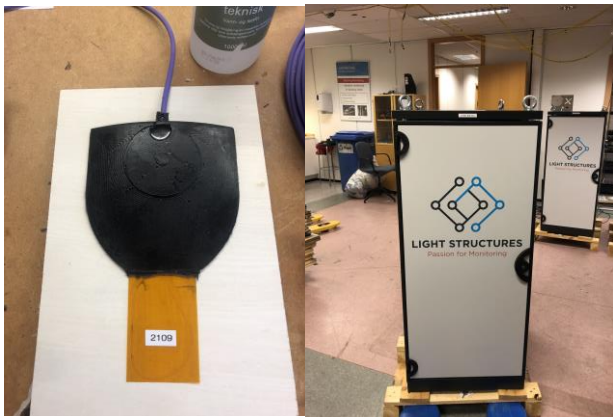
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KEY COMPONENTS

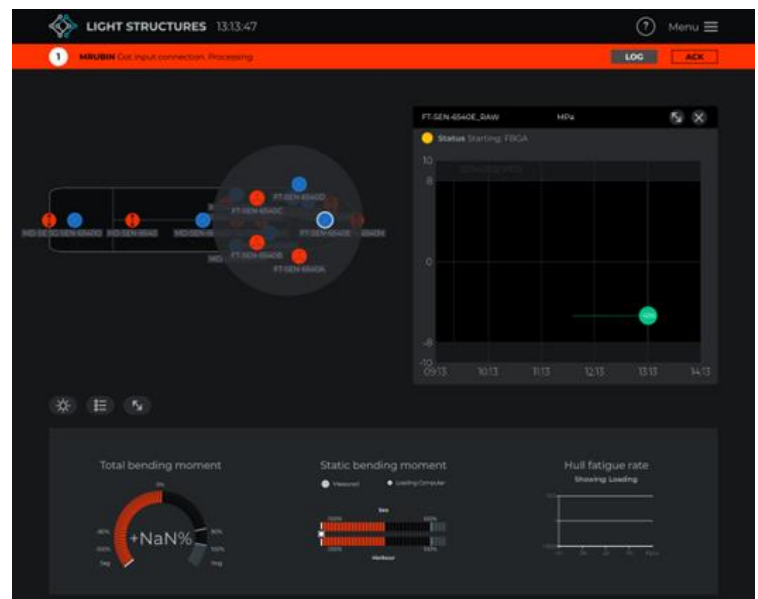
The system layout



The sensor & rack



Proprietary SW/GUI



Interrogator (FBGA)



ANALYSIS DIAGRAM EXTRACTIONS

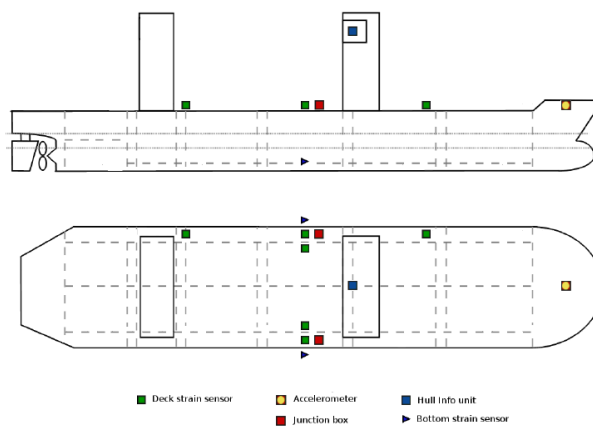
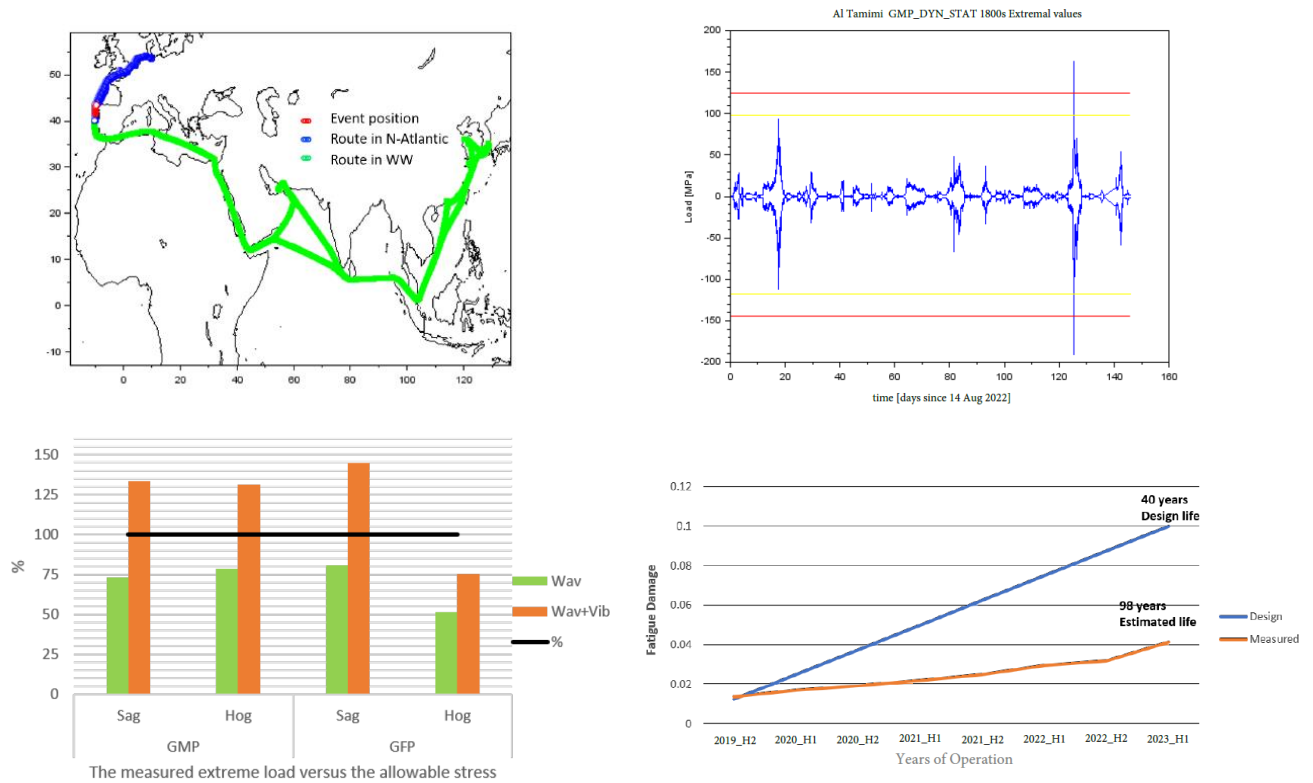


Figure 8: Outline of sensor positions

Contact Light Structures to find out how our structural health monitoring solutions can help to ensure the readiness of your fleet.



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