Fig. 1. Picture of the catamaran vessel.

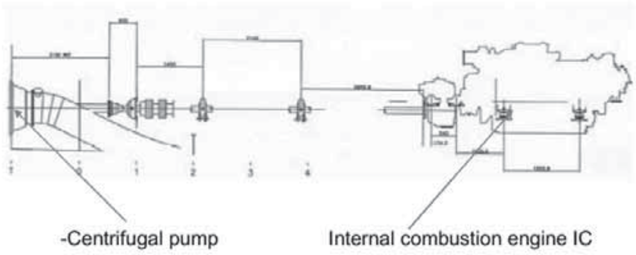

Fig. 2. Water jet room and engine room.

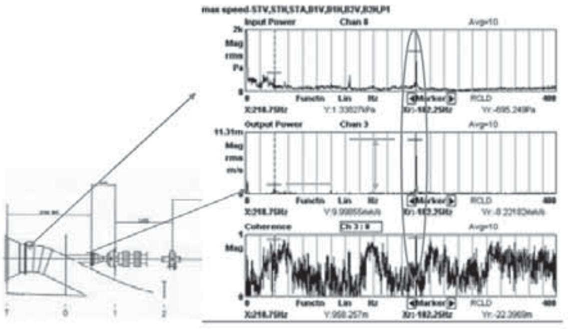

Fig. 3. Coherence between pressure pulsations and vibrations.

pressure pulsation generated by the pump. Vibrations at stern tube and duct were increased by a natural frequency in the range from 30 to 60 Hz. Another resonance could be observed around 100 Hz. This was confirmed by the transient analysis.

Vibrations in the engine room vibrations were produced by the internal combustion engine. In the water jet room, the highest vibration levels were found in stern tube, inlet duct and in the pump shaft bearing near the coupling.

The severity discussed by comparing the measured vibrations with the general Standard ISO/DIS 10816-3, as well as other marine guidelines [7].

The possible remedies are also discussed.

4. Conclusions

The analysis was able to identify the origin of vibrations generated by the pump the gear box and the internal combustion engine. Some critical operating conditions that could damage some parts of the vessel structure were identified.

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MARINE OIL MONITORIZATION BY MEANS OF ON-LINE SENSORS

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1. Introduction

The degradation and contamination of lubricating oil is the root cause of many severe machine failures. It also reduces equipment service life and frequently leads to unnecessary maintenance expense. This is true in all situations where machinery is deployed however, in the maritime environment the situation is exacerbated for all of the reasons we know so well. Lube oil is a critical fluid onboard ship. It is the lifeblood of propulsion and power generating engines and any quality failure leaves the vessel, its cargo, the community onboard and even the environment at the mercy of the most hostile operating condition on earth. Precise analysis of engine lube oil can only be performed in shore-based laboratories and the logistics of the maritime industry leaves operators with unreasonable extended periods between analyses. Over the intervening years field tests for basic lube oil parameters have been developed in an attempt to bridge this vulnerability gap.

This problem has been recognised as a critical area of vulnerability by operating engineers, engine manufacturers and standard setting bodies for around 20 years. Unfortunately, no adequate solutions were available and existing technology was unable to respond to the challenge. In recent times the increasing demand for machine lifetime reliability and unmanned classification exposed this deficiency and the rising cost of lubrication and environment sensitivity regarding spent lube oil disposal exacerbated the situation. In spite of this

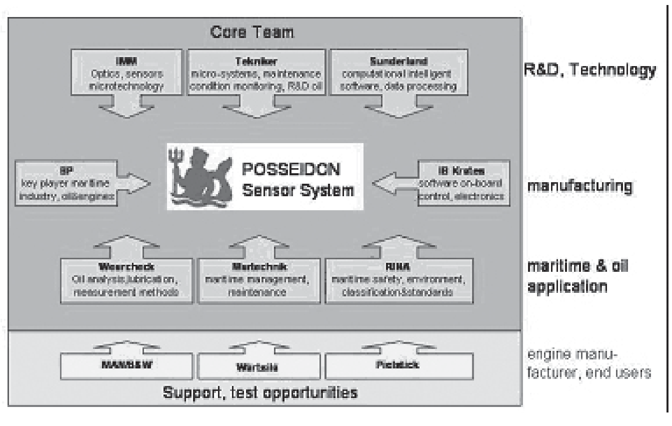

Figure 1. POSSEIDON Consortium.

pressing need the solution remained outside of the conventional technological disciplines of the user industries.

The consortium partners embrace a broad array of appropriate disciplines and experience to make it possible to finally achieve a solution for ships of all types and trades. Once achieved this break through will also benefit other extreme LO applications such as transportation traction units and remote power generating plant. The POSSEIDON consortium represents a truly trans-national and multi-disciplinary group that forms a strong platform on which to carry out this work. 8 partners from 5 countries will benefit from their specialised knowledge in technology, material science, lubrication, analysis methods, optical system design, fluidic handling and in the applications and need of the end user.
The programme entitled "Progressive oil sensor system for extenaba identification on line" carries the acronym POSSEIDON and it is therefore still "work-in-progress". The overall aim of the POSSEIDON project addresses the development of a complete sensor-based processing unit that can continuously monitor ships lubricated systems, in particular marine main propulsion and power generating engines, in order to provide an effective scrutiny over its serviceable life enabling non-skilled operating crews to predict degradation, anticipate problems and take remedial action before damage and failure occurs.

2. Results and Discussion
A marine propulsion diesel of the latest design (80,000kW) can cost around €20 million while the cost of the vessels they power can be measured in the hundreds of millions. It is therefore a massive capital investment waste to be "off-hire" for any longer than absolutely necessary.

An intelligence sensor system able to provide predictive wear rates based on an accurate understanding of the condition of the lubricating oil could enable operating engineers to extend the running time between surveys thereby realising a significant economic gain. This is true for both power and propulsion engines - the former offering significant economic benefits the latter providing potentially massive consequential rewards. Over the lifetime of a vessel this could result in significant savings in operational costs due to:
1. A reduction in the number of surveys performed
2. An increase in the time equipment is available for utilisation
3. Savings on material (including oil) and components held on stock and prematurely discarded.
4. Downstream benefits include lower insurance costs and a possible reduction in redundancy capacity for new buildings due to the reduced need for reserve equipment (particularly for generators).

The overall aim of this work is the development of an integrated sensor unit that can continuously monitor, alarm and record the key physical properties of main engine marine lubricating oil: Viscosity, Water-in-Oil, Base Number and Total Impurities). The system will provide effective scrutiny over the serviceable life of both the lube oil and the engine on-line.

The current practice in the maritime industry is for lubrication oil samples to be taken periodically by the ship's crew and dispatched to the lube oil supplier for analysis. After the samples have been analysed in some distant laboratory the results are passed to a technician for interpretation, advice and recommendation to be then communicated back to the ship or its operating company.

The main problems that occur within the engine, due to oil contamination and degradation are the
Following; Water & Soot & Fuel contaminants, Wear and Progressive deterioration.

The solution to these problems is focused on the development of on-line sensors systems that monitor or control water content, soot, total impurities, viscosity and TBN. The combination of these physical parameters is of importance to achieve reliable information about the above mentioned contaminations. This system will complement the actual operational conditions such as out-of-balance, misalignment or fatigue of mechanical elements. Recent research in IR analysis on micro-systems development in intelligent system applications demonstrates the positive contribution unattended on-line control can make in counteracting the aforementioned problems.

Nowadays, optical spectroscopy and related technologies can afford the development of these systems by using mainly miniaturised optics and fluidics. The technologies for manufacturing optical components and systems (ultra-precision machining, SU8-technology, electro-discharge machining, thin film technology…) are now existing to realise these lab-in-chip sensors.

3. Conclusions
Considerable innovation will be required to create reliable methodologies for continuously monitoring these four parameters to an acceptable degree of accuracy and reliability under marine conditions.

Concerning sensors, apart from the usage of new technology (micro and nano-technologies) and new analytical methods (resonance detection) which could make possible the development of reliable and reproducible sensor systems, it will be necessary to separately prove each parameter under the extreme operating conditions of a marine engine room.

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FLEXIBLE DATA ACQUISITION FOR MARINE RESEARCH BY JDDAC BASED SENSOR NETWORKS

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1. Introduction
A major objective of national and international initiatives is the build-up of seafloor observatories equipped with in situ physical, chemical and optical sensors systems able to be operated at water depths of more than 3000m. Such seafloor observatories will either be linked by underwater telecommunication systems, or will be installed as payload within mobile underwater vehicles. This requires new software and hardware concepts with regard to the interoperability of different sensors, integration into vehicle control systems, storage