Collection and Analysis of Data for Ship Condition Monitoring Aiming at Enhanced Reliability & Safety

Yiannis Raptodimos, Iraklis Lazakis, Gerasimos Theotokatos, Raul Salinas, Alfonso Moreno
Department of Naval Architecture, Ocean & Marine Engineering, University of Strathclyde
Glasgow, UK
TSI Technicas Y Servicios De Ingenieria, S.L., Madrid, Spain

ABSTRACT

This paper presents the onboard measurement campaign for the case study of a container ship and provides a customary methodology for monitoring important machinery systems. The main principle aim of this paper is to collect important machinery data and parameters from critical systems, located in the engine room of the ship, by determining systems to be monitored, scenarios for monitoring, sensors and suitable portable equipment and physical parameters to be inspected.

KEY WORDS: Maintenance; reliability; ship performance; condition monitoring; measurements

NOMENCLATURE

BBN Bayesian Belief Network
BS British Standards
C.W Cooling Water
CBM Condition Based Maintenance
CM Condition Monitoring
DSS Decision Support System
F.O Fuel Oil
IMO International Maritime Organisation
INCASS Inspection Capabilities for Enhanced Ship Safety
L.O Lube Oil
MRA Machinery Reliability Assessment
O&M Operation and Maintenance
P-F Potential-to-Functional failure
RBI Risk Based Inspection
RCM Reliability Centred Maintenance
T/C Turbocharger
Temp Temperature

INTRODUCTION

Maintenance is an important contributor to reach the intended life-time of technical capital assets and is defined as a combination of all the technical and associated administrative activities required to keep equipment, installations and other physical assets in the desired operating condition or to restore them to this condition (BS, 1993). Maintenance also includes the engineering decisions and associated actions that are required for the optimisation of specified equipment capability, meaning the ability to perform a specified function within a range of performance levels that may relate to capacity, rate, quality, safety and responsiveness. Furthermore, maintenance costs are a significant portion of the operational cost and breakdowns and downtime have an impact on plant capacity, product quality and cost of production as well as on health, safety and the environment. Thus, nowadays, the shift of maintenance as a strategic perspective within a company organization can be attributed to the utilisation of more advanced technologies, increased emphasis on safety, new environmental legislations, optimised operations with increased fuel efficiency and reduction of emissions (Parida et al., 2015).

Maintenance was initially treated as a course of action that could be accomplished in a random day by day operation. The main aim was not to lose operational time and to minimise unexpected failures. At first maintenance was nothing more than an inevitable part of production, thus it was considered as a necessary evil. Repairs and replacement were tackled only when necessary with no optimisation taking place. However in the last years this attitude has changed (Pintelon and Parodi-Herz, 2008) and is considered a strategic activity that ensures operation reliability systems and their associated components.

Maintenance tasks affect the reliability and availability standards of the shipping industry and are an important factor in the lifecycle of a ship that can minimize down-time and reduce operating costs (Lazakis and Olcer, 2015). The importance of maintenance is demonstrated by the fact that it is the only shipboard activity to have one whole element assigned to it (IMO, 1993). Also, due to the impact of shipping on the environment and the importance of the safe operation of ships; ship owners and operators pursue to adopt a maintenance plan and procedures that will reduce costs, promote the lifecycle integrity and enhance the energy efficiency of the ship.