A study of reliability-centred maintenance in maritime operations

A.J. Mokashia, J. Wanga,*, A.K. Vermarb

a School of Engineering, Liverpool John Moores University, Byrom Street, Liverpool L3 3AF, UK
b Indian Institute of Technology, Mumbai, India

Received 10 January 2002; accepted 7 February 2002

Abstract

This paper has identified specific problems likely to be encountered in the endeavour of implementing reliability-centred maintenance (RCM) on ships. These stem out of the cultural differences between the aviation and maritime industries. In the maritime industry, RCM is often considered resource demanding. It is, however, possible to make the project manageable by starting with a critical system. Considerable savings in time and effort can also be achieved by using a reverse logic where the failure modes are identified by analysing the maintenance tasks. A subjective qualitative approach has been proposed to overcome the limitations of the definitive logic used by the decision trees and the demand for failure data imposed by quantitative methods. A fuel oil purification system has been used as a test case to demonstrate its use. There is appreciation amongst both classification societies and equipment suppliers of the principles of RCM in the maritime industry. This makes the application of the RCM concept feasible. Finally, it is the seafarer, who will have to be on the forefront of this endeavour and total productive maintenance can be used to create the right work environment to achieve this. It is concluded that rather than looking at RCM as a methodology and trying to use it as such, it makes more sense to consider it as a philosophy and use its guiding principles to help the seafarer plan his maintenance strategy.

Keywords: Maintenance strategy; Marine operations; Reliability-centred maintenance

1. Introduction

Maintenance costs form a significant part of the overall operating costs in ship operations. Maintenance also affects reliability and can thus have environmental and safety consequences. The International Management Code for the Safe Operation of Ships and for Pollution Prevention (International Safety Management (ISM) Code) addresses the management aspects. These are considered to be closely associated with human error, which is responsible for up to 80% of the marine accident cases. The importance of maintenance is demonstrated by the fact that it is the only shipboard activity to have one whole element assigned to it (i.e. ISM Code element 10) [1].

ISM Code element 10 focusing on maintenance of ship and equipment inter alia states that “The Company should establish procedures in its SMS (Safety Management System) to identify equipment and technical systems the sudden operational failure of which may result in hazardous situations. The SMS should provide for specific measures aimed at promoting the reliability of such equipment or systems”. This is consistent with what reliability-centred maintenance (RCM) delivers. RCM focuses the maintenance resources only on those items that affect the system reliability, thereby making the maintenance programme cost effective on the long run.

However, most of the attempts to implement RCM on ships have been done by shore-based consultants or academics. To really benefit from the process the ship staff should be able to use it in their onboard maintenance analysis. This is because RCM results are based on the operating context, which keeps changing with the type of cargo, voyage, crew, etc.

RCM was initially developed by the aviation industry where it has delivered excellent results. This has encouraged various other industries to use it to improve their maintenance practices [2]. However, applying RCM to ships could have some hurdles. These include:

1. Lack and portability of failure data: There is no easy access to failure data as there is no composite
teams. Carried out to prevent inconsistent outcomes of the analysis, explicit guidelines on the way analysis is to be carried out individually for each ship and system. Probabilities elsewhere. Hence the analysis has to be accommodated in the maintenance plan.

(4) Shipboard personnel are already overburdened: Shipboard personnel are operators as well as maintainers. A complex and long methodology is not likely to find favour with them.

(5) Ships operate in isolation from repair and spares facilities: The failure mode analysis should give special attention to consequences resulting from the above.

(6) Lack of “adequate” redundancy: Traditionally, RCM assigns equipment with redundancy “run-to-failure”. While this makes sense in other industries with its multiple redundancies, it may not be desirable in shipping where critical systems usually have only single redundancies failure of which could be catastrophic.

(7) Rigid prescriptive requirements of various regulatory bodies: Ships come under the purview of different regulatory bodies including Port State, Flag State, Classification Society, etc. All these have to be accommodated in the maintenance plan.

(8) Recommendations from equipment suppliers have to be followed in the guarantee period: Non-compliance with the recommendations during this period could remove the supplier from any obligations in case of a claim.

(9) Equipment suppliers do not give a FMEA: Some industries and organisations require their suppliers to submit a FMEA of the equipment. This greatly helps implementing RCM. However, this is not the case in ship operations.

(10) RCM analysis results are unique to each operating context: The same pump working on a ship or in a system may have different functions, operating conditions, redundancies or even failure detection probabilities elsewhere. Hence the analysis has to be carried out individually for each ship and system.

(11) Ships crew keeps changing: There is a need to lay down explicit guidelines on the way analysis is to be carried out to prevent inconsistent outcomes of the analysis of the same system carried out by different teams.

There is therefore a need for a streamlined approach, which the onboard crew can use to identify and analyse their maintenance problems.
دریافت فوری متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات