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Creating value by integrating logistic trains services and maintenance activities

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Abstract

NedTrain is the Netherlands Railway's subsidiary responsible for rolling stock maintenance. Train sets are brought in for short-term routine maintenance after set intervals of some 75 to 120 days. When a major defect occurs, train sets are allocated to one of the three maintenance depots and are diagnosed and repaired. Removal from active service causes large amounts of withdrawal of trains. In the traditional production concept, major defects could not be repaired on spot by the service organization. A lack of knowledge and equipment forced the National Fleet Control Centre to send the trains to the maintenance depots. This led to the insight that an upgrade of the service process could lead to a substantial improvement of the availability of the fleet. NedTrain re-modelled the traditional production concept and decided to invest 25 million euros in 4 additional Technical Centres, strategically placed on major nodes in the train service operations. In these new Centres, major defects are repaired during the night. Also, the routing of empty trains to the depots is prevented. The Utrecht Technical Centre was opened in Spring 2014; the other Centres will start operations shortly. This investment will lead to an improvement of the fleet availability by over thirty cars (worth 60 million euros), savings that can be cashed in the next round of ordering rolling stock. This paper describes both the preparation of the service processes and the first results, measured in the Utrecht-case.

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Keywords: train service; repair; integration; Technical Centres, rolling stock; maintenance

1. Introduction

NedTrain is the Netherlands Railway's subsidiary responsible for rolling stock maintenance. Train sets are brought in at maintenance depots for short-term routine maintenance after set intervals of some 75 to 120 days. The relatively long maintenance intervals are due to the complex train operations schedule. In the Netherlands, most trains do not commute between fixed points but follow a complex path through the railway network. It takes a lot of effort to direct a train set to the workshop because of the train density on the rail network. Also, NedTrain has the policy to maximize the maintenance intervals, for long maintenance intervals are considered to be cost-effective.

The other side of the equation is a relative high number of unscheduled depot entries caused by train defects. These depot entries are responsible for more than half of the maintenance withdrawal from train service operations. In the last 10 years however, NedTrain has significantly improved in the field of availability by taking preventive measures in the field of fleet reliability and the quality of the repair processes. The next step and subject of this paper is to describe how the corrective maintenance organization has recently been improved, i.e. how NedTrain has integrated the repair of complex failures into the train service operations by building four so-called Technical Centres. This was done by an innovation of the production concept for the unscheduled depot entries. The production concept determines what to do where, and is an often overlooked step between the maintenance concept and the maintenance execution.

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2. The NedTrain maintenance network

2.1. Current maintenance locations

In the current production concept, two categories of train failures are known. Simple failures are handled nightly at 30 service locations, located at the Dutch marshalling yards. Complex failures are repaired at 3 large maintenance depots, for at the depots the highest level of mechanics is stationed. Directing defect trains to the large depots comes at the price of a reduced availability and is a time consuming job for the national fleet control Centre a well. Therefore, alternative 'smart' repair locations needed to be found, suitable for the building of Technical Centres.

2.2. Recent and future improvements

The decision to invest in Technical Centres for the repair of trains was preceded by some other important process improvements. These improvements laid the foundation for the new production concept described in this paper. Also, the new production concept will have to fit in to future improvements. Both past and future improvements are discussed in this chapter.

2.2.1. Improving fleet availability

In 2005-2010, preventive measures were taken to reduce the unplanned withdrawal for maintenance. A special Reliability Program was setup, targeting both the number N as well as the lead time L of the unscheduled depot entries was reduced by -25%, aiming at an amount of withdrawal W = N*L = 75% * 75% = 56%. This finally led to a reduction of the unscheduled maintenance withdrawal of 57%, bringing > 200 extra cars into train service operations.

2.2.2. Improving work force skills

The capability of the repair process depends largely on the capability of the mechanics. Two factors were addressed: knowledge and experience. A 'back to school' program was initiated to bring 100 frontline mechanics to a higher educational level. The level of experience was lifted by appointing a selection of eight specialized service locations. These locations specialize on a maximum of three stock types. The national fleet control Centre directs each stock type to the fitting specialized location, thereby increasing the case flow and maximizing the speed of learning.

2.2.3. Standardization of the repair process

In recent years, analysis showed that the repair process suffered from repeating failures. Besides the aforementioned measures (education & speeding up the learning process), the 'First Time Right' process was introduced, standardizing the repair workflow process. Important elements were the checking of the repair-history of the train and the development of fault-trees to support the diagnostic capabilities of the mechanics. The standardization of the repair process led to a reduction of the amount of repeating failures by 50%.

2.2.4. Introduction of fleet teams

In 2010-2015 NedTrain took measures to improve the maintenance organization, introducing a dedicated fleet team for each stock type [1]. The teams operate cross the organization and direct all the fleet aspects. In this phase, the number of stranded trains was significantly reduced. The development of the production concept for complex train repairs, as described in this paper, also fits into the same period.

2.2.5. Future improvements

Besides the implementation of the Technical Centres, NedTrain will focus in the period 2015-2020 on innovations both in the technical and the process field. Performance Centered Maintenance will lead to a more effective maintenance concept. Modularization of large maintenance blocks will make it possible to execute maintenance in off-peak hours. Real-time fleet monitoring will reduce the mean time to repair and improve the fleet reliability.

3. Problem statement

When major defects occur, train sets are allocated to one of the large maintenance depots, diagnosed and repaired. Removal from active service causes large amounts of withdrawal of trains, it usually takes 3 days to transport and repair a train. The main reason for the current lead time is the conflicting resource claim between regular maintenance of trains and the unscheduled repair of defect trains. Due to the unpredictable character of the defects workflow, increasing the workforce population or the number of depot lifting roads would lead to a significant increase of the depot inefficiency. Therefore, the question was raised whether it would be profitable to separate the repair of unscheduled depot entries from the regular maintenance process by executing these repairs at another location. As a consequence the project goal was set to develop a new production concept that would minimize the lead times of the repair of complex failures in order to increase the fleet availability.

4. Designing a new production concept for the repair process

The production concept design process would have to deliver a definition of the work package, a location selection, the requirements for the Technical Centres including a preliminary design and an impact analysis. Bases on this, a business case would be delivered comprising different scenarios and supporting decision making.

4.1. Defining the work package

In the air force, maintenance is generally organized into three distinct levels of maintenance: the organizational (O) level, the intermediate level maintenance (ILM) and the programmed depot maintenance or overhaul maintenance (PDM). Most aircraft failures are handled on the flight line (O-level) by direct repair or by replacing line replaceable units (LRU's), returning the aircraft to mission-capable status