Saker Solutions

◤ Part of the ITI Group

M&S Distribution Centre Design

- ■ Saker Solutions can provide support to clients using expert simulation modellers with experience in a wide range of industries.

- ■ Flexsim Simulation software is ideal for Warehousing applications because of its Material Handling Library, spatial modelling and 3D graphics

- ■ SakerGrid was used to reduce the testing time and provide answers to question quickly.

Marks and Spencer plc (M&S) is one of the UK's leading retailers, headquarters in London, with over 700 stores in the United Kingdom and over 400 stores spread across 44 territories. As part of a strategic change to its supply chain, M&S is investing in a new combined National Distribution and E-Commerce Distribution Centre at Castle Donington, Leicestershire. The new facility went live in April 2013, and is designed to provide M&S with much greater flexibility to meet its customer requirements, whilst minimising operating costs, allowing M&S to continually meet requirements of the dynamic market place in which it operates.

Whilst the new facility will offer huge improvements over the current infrastructure, which is spread around various geographical locations, M&S recognises that there is always a degree of uncertainty with regard to how a new facility, such as this, will perform under different operating policies and demands. To address this uncertainty, M&S engaged Saker Solutions to create a suite of simulation models to assess how the various systems within the centre will perform under different control rules and demand profiles. This case study provides an overview of the scope and benefits of these simulation models.

National Distribution and E-Commerce Distribution Centre

The M&S new distribution facility has a floor area of 900,000sq ft – equivalent to the size of 11 football pitches! However, it is not just the size of the facility that is challenging; the product range handled at the centre is vast and diverse. In total, around 150,000 different SKUs are received, stored, processed and dispatched at the centre. In any one hour, many thousands of orders can be processed; they include clothing, gifts, health & beauty and home products, literally everything from socks to laundry baskets! The complexity is exacerbated by the fact that distinct types of product have different storage and handling characteristics. Hanging goods are handled by overhead conveyors and stored on bars; boxed goods travel along belt and roller conveyors and are stored in totes / pallets whilst nonconveyable oversized goods need to be handled manually. With such differing product characteristics, the systems within the centre are therefore also distinct and complex.

Simulation of Warehouse and Distribution Facility

Order Types

With the facility acting as a combined NDC and Ecom Distribution centre, it needs to handle different order types, which are processed in different ways.

Store orders typically involve picking large quantities of single items which need to be collated by region, store and store department prior to dispatch. All orders are launched in waves with the resultant individual items that are picked being sorted, such that all required hanging items are collated in a hanging buffer and all boxed items packed into totes, which are stacked in dollies prior to being loaded onto dispatch trailers.

Ecom orders typically involve picking much smaller quantities of items; however, more complexity is introduced by the combination of pack type and the order type. Some items, for example a vase or a suit would normally be packaged in a box whereas a shirt would normally be packed into a bag. Customer orders for combinations of different categories of items (boxed goods, hanging garments and oversized items) introduce further complexity as these items must be collated at the same packing station, having being picked from different systems. In addition to product categories and pack types, M&S also offer their customers a choice of home delivery or collect in store. Store collection orders need to be collated by store; home delivery orders are delivered using a third party courier service. In addition, customers can elect to have their orders prioritised for next day delivery; this affects the time at which the order must be waived (launched), in order to meet the dispatch deadline.

The above combinations mandate that all of the individual systems perform as designed and any issues that would introduce delays and disturb the flows between the systems are identified and addressed. For these reasons M&S & Saker identified that each of the centre's key systems was to be simulated in order to validate the design of the facility and quantify the key aspects of its performance, under a specified set of operating conditions.

Key Areas

With such a vast array of products, product categories, order types and packaging types, it goes without saying that the new site encompasses many systems for receipt, storage, order picking, collations, packaging and dispatch; these include:
- Goods In (Hanging, Boxed, Manual)
- Boxed High Bay Storage (Palletisation, Storage, Depalletisation)
- Boxed Mini load & Pick Preparation (Carton Storage, Tote Preparation)
- Tote Picking System (Carousel Storage, Pick Stations)
- Order Tote Buffering
- Manual Storage (Oversized items, 'Uglies')
- Manual Picking
- Hanging Conveyors (Block Building, Transportation)
- Hanging High Bay Storage
- Hanging Manual Storage (Manual storage and picking)
- Hanging Dynamic Storage (Automated Picking)
- Hanging Consolidation (sorting by orders)
- Ecom Order Packing (different pack types and order types)
- NDC Dispatch
- Ecom Dispatch
- Cross Docking
- Vehicle Loading

Understanding how each of these systems perform individually and how they perform holistically is imperative. A suite of simulation models was created representing the various systems in the internal supply chain, from goods in to dispatch. Where appropriate, the output from one simulation model was used to generate the work profile for the downstream simulation model, in order to understand how the storage and transportation systems mitigate interference and to identify knock on effects between the various areas.
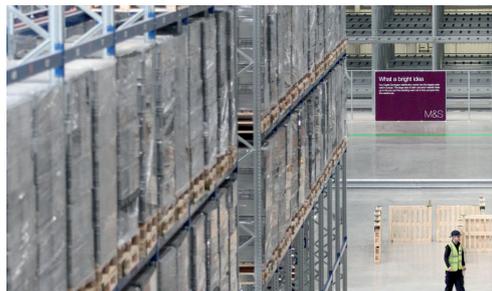
The Solution

Simulation modelling involves creating a computer model to mimic a real logistics process or supply chain. Simulation's unique time based approach, in conjunction with the ability to reflect the factors that vary, enables models to accurately mimic the complexities of a real life system. Alternative scenarios can be evaluated in order to quantify performance in advance of implementation. This enables proposals to be finetuned to exploit opportunities and allows the interested parties to arrive at a consensus reinforced through a proven methodology. The uncertainty and risk associated with major business decisions, involving extremely complex processes, is mitigated.

Simulation models encompass a dynamic animation reflecting the status of all aspects of the model. For example, totes and hanging garments are seen flowing along the conveyors and through the various processes. The animated screen makes use of 3D icons to represent the equipment, workstations and products. This provides a superb communication medium for all stakeholders involved in designing and working in the facility.

The simulation models were built using the Flexsim Simulation Software. Having had previous experience of other simulation software M&S invested in Flexsim simulation software following discussions with Saker Solutions in 2009. M&S concluded that the Flexsim simulation software was the ideal simulation software platform for their needs for a number of reasons. Firstly, Flexsim's 3D visualisation means that simulation models are instantly recognisable representations; this is particularly important for management presentations. In addition, M&S recognised that the combination of Flexsim's straightforward drag and drop model building methodology, underpinned by standard drop down lists defining the behaviour of objects at specific events, which is fully customisable with C++ syntax, means that the Flexsim simulation software is not only easy to use but it is also very powerful. Both of these characteristics are key for the successful development of complex logistics models. M&S initially used Flexsim simulation software to evaluate the layout of a proposed warehouse in Stoke, in order to understand whether any limitations could be identified in its layout prior to commissioning of the facility.

Flexsim's graphics have allowed M&S to involve numerous stakeholders into the evaluation process, where they are able not only to obtain quantitative results from the models, but also understand the underlying factors behind the performance. Moreover, because the Flexsim simulation software accurately represents how much space is taken by individual entities, stress testing aspects of the facility allows the impact of any build back of orders, items or packages to be shipped, to be seen in the automated systems. This provides an enhanced understanding of how the system will perform in real life and more confidence in the agreed solution.

In developing the models, Saker Solutions also developed a front end which combined SKU product details, initial stock positions, detailed order profiles and facility configuration parameters. Actual data was analysed and extracted from a company database to ensure that the models were being run with true data; at the same time, the front end allowed the number of workstations, activity durations and speeds to be varied. This provided M&S with the ability to stress test different facility configurations with their own data. The front end collected detailed results on each aspect of performance; these were presented as pivot tables and charts to facilitate detailed analysis of performance by M&S logistics specialists.

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Benefits

The aforementioned systems are inherently complex; M&S are using the simulation models to highlight any potential issues and provide a vehicle to undertake 'what if' analyses in order to provide a better understanding of how performance can be optimised. M&S's models are being used to address the following key questions:

- Does the system perform as required (both holistically and in the specific areas of concern)?
- Is it scoped correctly (are the correct amount of workstations and buffering specified to strike the correct balance between capital cost and performance)?
- Is any debottlenecking required, and if so where and how should be achieved?

Expert Advice

Saker Solutions Limited is an independent supplier of simulation software and services. Using experience gained in over 100 years of working in industry, the Saker Solutions team have been involved in applying simulation to a wide range of application areas. Saker has the ability to help clients achieve real business benefits from the use of this exciting technology.

Saker Solutions operates in partnership with a variety of organisations to ensure that clients get the right solutions for their requirements. With a depth of experience in providing simulation services to a large variety of major companies, Saker can offer simulation consulting, modelling and training services, as well as working with clients to help identify the right simulation software to use. In addition Saker Solutions can offer support for a variety of simulation software products including Flexsim, Simul8, Anylogic, Witness and Avert.

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