



# final report

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## Development of container loading concept using rapid prototyping methods– Phase 1

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## Executive Summary: Summary

The current project evaluated and tested a pre-production prototype concept for handling and automated conveyance of product into 20 and/or 40 foot containers. John Dee used simplified rapid prototyping methods to build a proof of concept with the required assumptions to be tested and proven cost-effectively and without the risk of lengthy development timeframes. Validation of an automated proof of concept was able to be achieved by assembling and modifying existing product handling and container loading equipment. Considerable efficiencies were shown to be gained by modifying a fork lift with carton handling devices including and conveyors fitted to allow the fork lift to be manually controlled in pilot trials. The project as an initial proof of concept has been able to demonstrate a pre-production prototype proof of concept for carton handling and container loading. Additionally the project has provided the opportunity to develop new skills and capabilities in John Dee to cost effectively evaluate ideas to proof of concept (i.e. rapid prototyping).

The outcome of the project has been a successful demonstration of and the efficient and cost-effective method based on a pre-production prototype concept for container loading using simplified rapid prototype methods. The project was designed as a demonstration of how to build skills and capabilities within the company and specifically the program engineering group to be applied cost effectively on future materials handling initiatives.

Ongoing testing and container loading runs using this initial prototype version is underway to assist with the design of future scale up versions of the container loading concept. This project is the first step in a wider material handling program to improve efficiencies and safety at John Dee Warwick. A stage 2 of the project is under development and proposes to develop and test a production version of the container loading concept.

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# 1 Background

John Dee recognises that a customised service offering to their customers is critical for their future prosperity. With increasing customised ordering comes a high level of complexity. John Dee has a strategic imperative over the next three years of transforming and revolutionising materials handling with operational targets of optimising production efficiencies with up to 60% reduction of current labour units. John Dee's strategy to remain competitive will also address the required skills and capability, information intelligence and systems required in such a comprehensive and sophisticated material handling system. John Dee's approach will be a whole of chain approach from boning room through to container loading and be transformational in the way that the company handles, tracks, stores, buffer and load-out individual chilled cartons. John Dee has carried out substantial background work and planning in materials handling. A staged proof of concept process is proposed to build various modules and develop John Dee's capability.

The first key materials handling focus area for John Dee will be in product handling associated with container loading. Container loading is a tedious manual process with associated operator risks. There are workplace and occupational safety risks associated with manual handling of cartons in 20 and 40 foot containers. Earlier attempts to automate this area in the past have been unsuccessful with fragmented and adhoc process changes being implemented producing minimal incremental improvements in labour savings and limited safety benefits. John Dee proposes a proof of concept for container loading to overcome the high costs and long development lag periods that are currently being experienced with a current industry funded projects with little tangible returns to date.

## 2 Project Objectives

The primary objective of this work was to evaluate the use of rapid prototyping methods to cost-effectively test pre-production proof of concept in product handling and container loading.

The specific project objectives were to:

- Demonstrate a proof of concept for carton handling and container loading
- Develop skills and capabilities in John Dee to cost effectively evaluate idea to proof of concept (ie rapid prototyping approach)
- Develop a roadmap and work schedule for evaluation of an automated pre-production commercial option for product handling and container loading

## 3 Methodology

The following approach was applied:

### 3.1 Preliminary evaluation of pre-production container loading proof of concept (Phase 1)

A project team consisting of John Dee and MLA technical experts was formed. A kickoff meeting of the project team was established to update on existing container loading processes, identify current constraints and opportunities for alternative approaches and agree on targets and goals of the project. A review of the current operations was conducted by walking the entire process and establishes the operation parameters for a successful alternative approach

to product handling and container loading. A simple proof of concept trial using cartons and conveyors was undertaken and captured via video to demonstrate movement of cartons (see photo 1). The outcome was a design concept plan of an automated proof of concept including a work schedule signed off by John Dee / MLA project technical group.



**Photo 1:** Carton layout to assist with development of the prototype design concept.

### **3.2 Build pre-production prototype and preliminary evaluation (Phase 2)**

The pre-production prototype was constructed using a series of existing product and/or pallet moving plant equipment including conveyors, a fork lift and manual handling gigs (end effectors) modified and assembled in a test environment. A series of trials using empty cartons and manual handling techniques was undertaken to refine design concepts in the engineer's workshop.

### **3.3 Conduct container pilot trial using pre-production prototype and modified equipment (Phase 3)**

A series of pilot runs was initially undertaken in the engineering workshop by project group with chilled and/or frozen cartons. Data was recorded on potential loadout cycle times. Data captured and video footage of pilot container loading trial using pre-production prototype and modified equipment demonstrated over several loading cycles.

John Dee conducted a limited number of pilot trials at the back dock to demonstrate the process and evaluated under pre-production proof of concept conditions for product handling and container loading.

## **4 Findings**

The picking and packing area is a key stage in the supply chain which impacts on product quality (damaged product), traceability (lost & misdirected product), cost, and labour sustainability (OH&S). Work in this area may also allow the industry to take advantage of new technology opportunities in mobile robotics, and flexible reconfigurable materials handling.

It has been demonstrated that current manual refrigerated container loading practices currently consumes considerable manual labour (plants may have up to 5 people loading a container) with associated occupational risk costs due to the volume of heavy lifting. John Dee has been able to demonstrate that a potential automated solution cost such as the concept evaluated in this project may cost in the order of \$100k, and a less than 4 month payback based on labour savings. In additional it is anticipated there to be additional OH&S benefits over and above labour savings. The benefits are proposed to be evaluated by John Dee as part of the concept proving project.

The primary benefits for John Dee for an automated container loading solution such as the current prototype concept has demonstrated to overcome the following business related issues:

- Sales requirements call for increased assembly of mixed products,
- Storing products and calling on first in first out product is a labor intensive task,
- Products requiring immediate shipping need to be fast tracked to eliminate double handling,
- OH&S issues with manual handling, and
- Labor intensive.

## **5 Key Outcomes**

The outcome of the project has been a successful demonstration of an efficient and cost-effective method based on a pre-production prototype concept for container loading using simplified rapid prototype methods. The project was designed as a demonstration of how to build skills and capabilities within the company and specifically the program engineering group to be applied cost effectively on future materials handling initiatives.

## **6 Recommendations – Areas for growth & Development**

Ongoing testing and container loading runs using this initial prototype version is underway to assist with the design of future scale up versions of the container loading concept. This project is the first step in a wider material handling program to improve efficiencies and safety at John Dee Warwick. A stage 2 of the project is under development and proposes to develop and test a production version of the container loading concept. The next phase R&D is proposed to scale up the rate of production and use more commercial materials.