

A stylized map of Southeast Asia, including countries like Thailand, Vietnam, Laos, Cambodia, Myanmar, and the Indonesian archipelago, rendered in a light blue color against a darker blue background. The map is overlaid with faint, abstract white lines and shapes, suggesting a global or networked context.

**LCA Case Study**

# **Warehouse Design**

*February 2009*

## The client

Created as a joint-venture between two of the world's leading airlines, this client is a Maintenance Repair and Overhaul (MRO) provider based at one of Asia's busiest airports.

The client services not only the JV partners' aircraft, but those of a rapidly expanding customer base of international airlines from Asia, Europe and the US – including some of the best known names in the business.

The client's Material Management department is responsible for all purchasing, handling storage and supply operations. They must achieve a very high level of product availability to support the overhaul operations while also ensuring rapid turn-around of any aircraft that arrives at the airport with technical problems.

## The issue

The client wished to improve control and effectiveness by consolidating all Materials Management operations from 13 locations into a single facility. Being airport based, space for the new structure was extremely limited. The only plot of available land was less than 10,000M<sup>2</sup>.

The Materials Management department has 220 people (office and operations) and is responsible for a high value inventory of over 60,000 active SKUs, some held under customs bonded storage, and all subject to aviation authority guidelines. The product range stretches from tiny widgets up to aircraft engines of 120M<sup>3</sup>. Some are dangerous goods, some are long-lengths (up to 6M), some require environment controlled conditions and others need electrostatic protection.

Certain components require lifetime tracking, which means that item specific paperwork must also be securely filed and matched with the part upon movement.

From a commercial perspective, the new facility will become a component of the client's sales pitch – lifting the corporate image while demonstrating a high degree of product care and operational effectiveness. Based upon growth trends, the new facility will have to cater for 15% per annum growth in volumes over the next 5 years.

## The solution

Because there were so many constraints that had to be catered for, we decided to enroll all directly concerned parties into the design process. This included the architects, the client's senior management, internal customers (the departments actually servicing the aircraft), the current operators, and other staff responsible for key issues such as IS/IT, safety, security, customs clearance and product care.

Within the above group, we operated a core design team – comprising of the design consultant, an analyst and two of the client's staff, both with broad working knowledge of MRO materials management operations. Their role was to gather, confirm and evaluate information pertaining to the facility, while absorbing as much "know-how" as possible from the design consultant.

(A critical initial step was to develop and sign-off detailed operating processes for the new site. This was a substantial task which involved detailed negotiation with the ERP vendor.)

### PROJECT QUICK FACTS

**CLIENT TYPE:**

Aircraft Maintenance

**SECTOR:**

Aeronautics

**BUSINESS SCALE:**

Confidential

**PROJECT OBJECTIVE:**

Design optimum warehouse to meet future growth and service demands

**SOLUTION:**

Small footprint building – integrated with existing structures to maximise potential capacity

We used an iterative design process. A series of “Challenge Sessions” were scheduled, with attendance from all involved parties strictly enforced. These sessions used a standard 5-step process to address each issue:

- 1 What have we learned to-date
- 2 What we still need to know
- 3 How current knowledge has been applied in the design
- 4 What we plan to do next
- 5 Where do we need help?

The table below provides two (early) examples of how this worked.

Step	Example 1 – Initial Warehouse Scaling	Example 2 – Engine Store Design
What we have learned to-date	<ul style="list-style-type: none"> <li>An initial survey of the 13 stores has provided a rough breakdown of volume per category of inventory</li> </ul>	<ul style="list-style-type: none"> <li>Engines permanently sit on special trolleys, moved on and off-site by small tractors</li> <li>Quantities and types of engines to be stored – together with likely movements</li> <li>Emergency requirement may mean engine being dispatched within 15 minutes of instruction being received</li> </ul>
What we still need to know	<ul style="list-style-type: none"> <li>A detailed breakdown of the inventory range by category and by handling &amp; storage characteristics</li> <li>How much of the current inventory is obsolete?</li> <li>Future inventory holding projections</li> </ul>	<ul style="list-style-type: none"> <li>Dimensions of the new A380 engine (2 variants)</li> <li>Maneuverability of tractors when reversing with large engines</li> </ul>
How current knowledge has been applied in the design	<ul style="list-style-type: none"> <li>Distinct storage zones are likely – each requiring specific equipment types</li> <li>Initial design capacity is insufficient to meet growth projections</li> </ul>	<ul style="list-style-type: none"> <li>“Garage” doors required along one wall of facility required for flexible access to engines</li> </ul>

<p>What do we plan to do next</p>	<ul style="list-style-type: none"> <li>• A more detailed review of physical inventories</li> <li>• A separate (desk-based) estimate of inventory volumes – in order to cross-check the results of the physical review</li> <li>• An assessment of current operating processes and initial development of new SOPs</li> </ul>	<ul style="list-style-type: none"> <li>• Set-up trials to assess door width required for safe maneuvering of engines</li> <li>• Review cost of removing pillars from engine store (to increase flexibility)</li> </ul>
<p>Where do we need help?</p>	<ul style="list-style-type: none"> <li>• Assembly of a temporary task-force to get a detailed assessment of physical inventory dimensions and characteristics</li> <li>• Assignment of a small team of experienced staff to complete the desk-based estimate of volumes</li> <li>• A list of which items can viably be excluded from the new facility</li> <li>• A short-listing of approved suppliers for likely types of storage and handling equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Request dimension specifications from A380 engine suppliers</li> <li>• Organizing of maneuverability trials</li> <li>• Cost alternate door types</li> </ul>

## The result

The Challenge Session approach allowed us to develop a basic design, satisfying everyone's needs, within a reasonably short timeframe.

Capacity was always going to be the critical issue. We conduct two separate inventory reviews (and cross-checking the results) to be absolutely sure of our facts. We were then able to demonstrate that a thoughtfully designed warehouse would comfortably meet the businesses needs over the next five years.

### Key design feature includes:

- The incorporation of four existing structures into the design:
  1. A small warehouse connected to the new structure for use as the receiving/dispatch unit
  2. A small warehouse to house support functions such as metal cutting and carpentry
  3. A small office block converted to become a secure filing centre
  4. A small office block converted to provide locker, shower and toilet facilities
- A canopy and boom-gates between the two existing warehouses to provide an all-weather, high security loading zone
- Protecting the store against extremes of temperature – as per aviation authority guidelines
- Integrating a 3-story section into the facility to provide
  1. Ground level access and storage for trolley mounted engines
  2. Second floor air-conditioned storage of light components
  3. Second floor server rooms and accommodation for the IS/IT department
  4. Third floor departmental offices – with a vista out across the airfield

- Protecting inventory and information integrity by:
  1. Funneling all arriving/departing personnel through a single security zone
  2. Limiting store access (via turnstile) to staff/visitors with electronic security tags
  
- Catering for the wide range of product categories through 8 distinct storage zones:
  1. Engine store designed for flexible tractor/trolley access
  2. Air-conditioned store (1<sup>st</sup> floor, above engine store)
  3. 3 level picking mezzanine for small parts
  4. High-bay racking (incorporating long-span shelving) for reserve storage and picking of medium components
  5. Cantilever racking for storage of heavyweight long-loads
  6. Pigeon-hole shelving for storage of lightweight long-loads
  7. Cantilever shelving (above the pigeon-hole shelving) for storage of rubber seals
  8. Dangerous goods (external structure)

During the initial design phase, constant liaison with the architect was maintained – primarily to ensure that the design remained cost effective by constantly asking, “Is there a lower cost way to achieve the functional requirement”.

Once the basic design was completed and approved, the core team progressed to work more intensively with the architects, developing a comprehensive specifications document. This document was then used as the basis for the architects’ detailed construction drawings which, in turn, were the basis for securing competitive quotes from building contractors.

The final design is unanimously agreed to meet all functional requirements, while being highly efficient in use of space. The facility will underpin planned process and control improvements while supporting the client in selling their services to international airlines. It will also offer a first class working environment for both operational and office staff.

This facility is due to be commissioned in mid 2009.

**TO FIND OUT MORE  
ABOUT LCA AND  
ABOUT WHAT WE  
DO, PLEASE  
CONTACT:**

**CONTACT:**

John Talbot  
Managing Partner

**MOBILE:**

+6012 290 2625

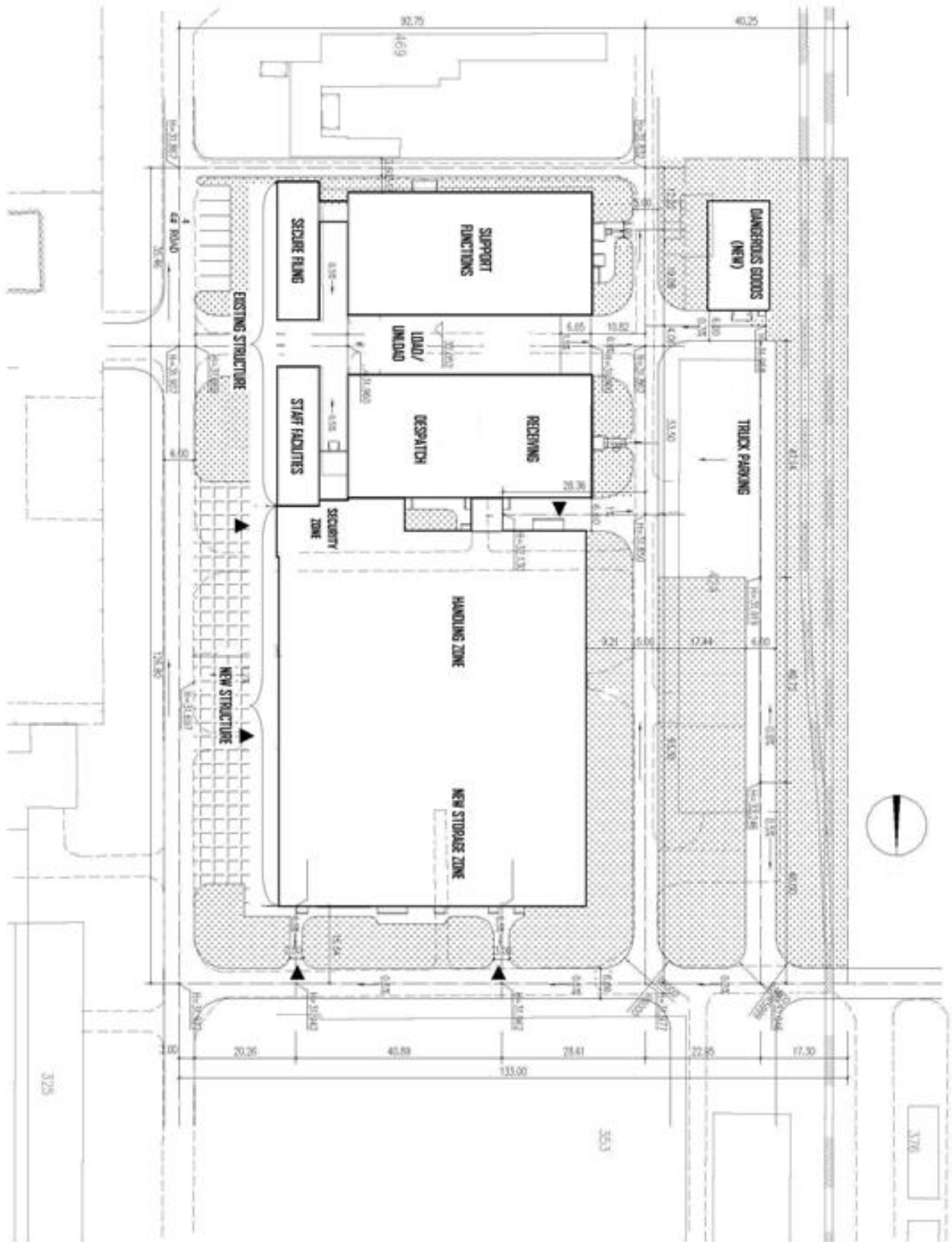
**EMAIL:**

john.talbot@lcalink.com

**WEBSITE:**

www.lcalink.com

# Overall Site Layout



# Floor-Plan Extract

