Agenda

Welcome

Introduction to Paper Plane Inc.

Production Round 1

Introduction to Lean Manufacturing

Round 2 Training

Production Round 2

Wrap-up – “Time to Fly”
Agenda

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Wrap-up – “Time to Fly”
WELCOME to Paper Plane Inc. (PPI)
Paper Plane Inc.

Product Catalog

SPRUCE GOOSE

“It will only fly once”
Production Process Orientation

- Raw Material (paper)
- Assembly Work Centre 1
- Assembly Work Centre 2
- Assembly Work Centre 3
- Assembly Work Centre 4
- Finished Goods (planes)
JOB ALLOCATION
Engineer

• Record Throughput Time Studies (Green Paper) (FIFO)
• Record defects
  • 1 defect is equal to \( \$20 \)
• Record WIP Level
  • 1 plane = \( \$10 \)

Quality Control

• Ensure PPI quality standards are being reached and stop line if there is rework or defects
• Ensure that all employees are focused on quality not output
• “Work at a Comfortable Pace”
Assembly Work Centre 1

Fold up in half long way
Assembly Work Centre 2

Fold first corner down on each side
Assembly Work Centre 3

Second fold of wing in each side

Draw a Star with a coloured marker on one side
Assembly Work Centre 4

Third fold of each wing on each side

Place in finished goods inventory

Spruce Goose
Company Policies

- All shifts are 20 minutes
- Keep busy at all times
- **Yell** if you need work
- Handle all parts first-in, first-out (FIFO)
- Stay at your workstation
- The boss is *always* right!
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Production Round 3

Implementation

Wrap-up – “Time to Fly”
Round One: Debrief

• Discuss results
• Discuss the process
• Lessons learned
• Relationship to real world
• “What if” scenarios
• Continuous improvement
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Wrap-up – “Time to Fly”
Reduced Lead Time

“One of the most noteworthy accomplishments in keeping the price of Ford products low is the gradual shortening of the production cycle. The longer an article is in the process of manufacture and the more it is moved about, the greater is its ultimate cost.”

— Henry Ford, 1926
Defining Lean

Lean is:

“A systematic approach to identifying and eliminating waste (non-value added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection.”

— The MEP Lean Network

“Getting the most out of the resources you already have”

- Eric MacDonald
Catalyst Connection
<table>
<thead>
<tr>
<th>Definition of Value-Added</th>
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<tbody>
<tr>
<td><strong>Value-Added</strong></td>
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<tr>
<td>Any activity that increases the market form or function of the product or service. <em>These are things the customer is willing to pay for.</em></td>
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Lean = Eliminating Waste

Non-Value-Added
- Defects
- Overproduction
- Waiting
- Not Developing People
- Transportation
- Inventory
- Motion
- Excess Processing

Typically 95% of all lead time is non-value-added.
What wastes are apparent in your organization?
Eight Wastes:

- Overproduction
- Inventory
- Motion
- Waiting
- Non-Value-Added Processing
- Defects
- Underutilized People
- Transportation
Overproduction

- **Making more** than is required by the next process
- **Making earlier** than is required by the next process
- **Making faster** than is required by the next process

**Causes of overproduction:**

- Just-in-case logic
- Misuse of automation
- Long process setup
- Uneven scheduling
- Unbalanced workload
- Over engineered
- Redundant inspections
**Inventory**

• Any supply in excess of a one-piece flow through your manufacturing process

**Causes of excess inventory:**

• Need for buffer against inefficiencies and unexpected problems
• Product complexity
• Unleveled scheduling
• Poor market forecast
• Unbalanced workload
• Misunderstood communications
• Reward system- buy bulk
• Unreliable shipments by suppliers
Defects

• Inspection and repair of material in inventory

Causes of defects:

• Weak process control
• Deficient planned maintenance
• Inadequate education, training, or work instructions
• Product design- non-manufacturable
• Customer needs not understood
Excessive Processing

- Effort that adds no value to the product or service from the customers’ viewpoint

Causes of processing waste:

- Product changes without process changes
- Just-in-case logic
- True customer requirements not clearly defined
- Over-processing to accommodate downtime
- Lack of communication
- Redundant approvals
Waiting

• Idle time created when waiting for…?

Causes of waiting waste:

• Unbalanced workload
• Unplanned maintenance
• Long process setup times
• Misuses of automation
• Upstream quality problems
• Uneven scheduling
Not Developing People

• The waste of not using people’s mental, creative, and physical abilities

Causes of people waste:

• Old guard thinking, politics, the business culture
• Underutilized people
• Poor hiring practices
• Low or no investment in training
• Low pay, high turnover strategy
Any movement of people or machines that does not add value to the product or service

**Causes of motion waste:**

- Poor people or machine effectiveness
- Inconsistent work methods
- Unfavorable facility or cell layout
- Poor workplace organization and housekeeping
- Extra “busy” movements while waiting
Transportation

- Transporting parts and materials around the plant

**Causes of transportation waste:**

- Poor plant layout
- Poor understanding of the process flow for production
- Large batch sizes, long lead times, and large storage areas
What Can We do About Wastes?

*Non-Value-Added*

Any activity that does not add market form or function or is not necessary.

*These activities should be eliminated, simplified, reduced, or integrated. How???
Building Blocks- The House of Lean

Continuous Improvement

- Pull/Kanban
- Cellular/Flow
- TPM
- POUS
- Quality at Source
- Quick Changeover
- Standardized Work
- Batch Reduction
- Teams
- Visual
- 5S System
- Plant Layout

Value Stream Mapping

Culture – Employee Engagement - Morale
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Wrap-up – “Time to Fly”
Round Two: Company Instruction

Learn how to implement new Lean techniques:

- Pull System/Kanban
- Eliminate Bottle Neck
Push versus Pull Systems

**Push System**
Resources are provided to the consumer *based on forecasts* or schedules

**Pull System**
A method of controlling the flow of resources by replacing only what has been consumed
Pull System

Pull System is a flexible and simple method of controlling or balancing the flow of resources. Eliminating waste.

Pull System consists of:

- Production based on actual consumption
- Small lots
- Low inventories
- Management by sight/Kanban
- Better communication
Visual Controls

• A “9th Waste” – Excessive Questions

• Three responses when questions are not answered:
  • Do nothing and just wait until the answer shows up
  • Go hunting for the answer
  • Make stuff up and go with the best guess
Eliminating Bottlenecks via Operator Balance

3 Steps:

1. Establish Takt Time
2. Review Work Sequence
3. Combine Work to Balance Process
Step 1: Establish Takt Time

Takt Time = Customer Demand Rate
Takt Time = (Work Time Available ÷ Number of Units Sold)
Takt Time = (1200 seconds ÷ 115 planes) = 10.4 sec/board

Cycle Time ÷ Takt Time = Minimum Number of People

Goal: Produce to Demand
Step 2: Review Work Sequence

- Observe sequence of tasks each worker performs
- Break operations into observable elements
- Identify value-added versus non-value-added (NVA) elements and minimize NVA
- Study machine capacity, cycle times and changeover times
Step 3: Combine Work to Balance Process

Takt Time = 10 seconds

Unbalanced Line

Balanced Line

Operations

Seconds

A
B
C
D
E
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Thank You

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