John Hall, Plant Logistics Manager, CNH Wichita Skid Steer, Compact Track Loader Operations
The development of World Class Manufacturing

WCM was developed by Fiat and partnering firms in 2005. Hajime Yamashina, Professor Emeritus at Kyoto Universality in Japan, played a key role. From the outset, all Fiat-group companies took part in the new journey towards operational excellence. Consequently, WCM was launched in Fiat’s automobile and powertrain divisions, in Maserati, in Lancia, in Alfa Romeo, and so on. The Fiat-owned companies CNH (manufacturer of Case agricultural equipment and New Holland tractors) and the truck- and engine manufacturer Iveco also use WCM as their XPS. In fact, today, companies as varied as the Royal Mail, Ariston (manufacturer of white goods), Unilever (consumer goods), Atlas Copco (industrial tools), Barilla (pasta) and 12 different transportation companies reportedly use the WCM concept.

The Chrysler Group joined the WCM when Fiat acquired majority shares in 2009 (as a consequence of the financial crisis driving Chrysler to bankruptcy). Today, Chrysler is known as the Comeback Kid. The incredible transformation is partly credited the WCM as a change program. A stronghold of choosing WCM as an “off-the-shelf XPS” is that companies that join, get the benefit of a world class benchmark from the other participating companies. Today, 166 manufacturing plants in 16 countries are active partners in the worldwide WCM Association. 30 of these are Chrysler plants, whereas 45 belong to Fiat.
WHAT IS WCM?

- WCM is a proven continuous improvement methodology
- Helps prioritize resources to attack problems and losses
- Aims to achieve safe, sustainable manufacturing processes with ZERO loss and ZERO defects
WCM PILLARS

TECHNICAL PILLARS

- SAFETY / HYGIENE & WORKING ENVIRONMENT
- COST DEPLOYMENT
- FOCUSED IMPROVEMENT
- AUTONOMOUS ACTIVITIES
- PROFESSIONAL MAINTENANCE
- QUALITY CONTROL
- LOGISTICS AND CUSTOMER SERVICE
- EARLY EQUIPMENT & PRODUCT MANAGEMENT
- PEOPLE DEVELOPMENT
- ENVIRONMENT

MANAGERIAL PILLARS

- Williams: Management Commitment
- Powell: Clarity of Objectives - KPI
- Vasanth: Route Map to WCM
- Horsch: Allocation of High Quality People
- Schulte: Commitment of the Organization
- Davenport: Competence of the Organization
- Hall: Time & Budget
- Burkholder: Level of Detail
- Stradtman: Level of Expansion
- Callaway: Motivation of Operators
SAFETY

SAFETY IS PARAMOUNT

- **PREVENT** safety hazards
- **PROTECT** the workforce from risks and injuries
- **PRESERVE** safe working conditions always

WCM aims towards **ZERO** unsafe acts and **ZERO** unsafe conditions
This is WCM’s Compass for all pillars

- Provides clear **Direction** towards top losses
- Helps **Prioritization** of resources for **maximum benefit**
- Tracks **Progress** of pillar projects and financials
FOCUSED IMPROVEMENT

Technical Pillar for FOCUSED Projects

➢ Work with a clear scope on a Specific problem
➢ Focused projects generally use specialized tools for specific problem solving
WORKPLACE ORGANIZATION

Pillar for workplace design to attack

- **MUDA** – Waste (Overproduction, Inventory, Wait time, Motion, Transport, Rework, Over-processing)
- **MURI** – unreasonable burden
- **MURA** - variation, inconsistency

Utilizes most of the IE tools to identify, measure and provide solutions to problems
AUTONOMOUS MAINTENANCE

Pillar that ensures daily basic conditions

- Cleaning and inspection **Calendars**
- Daily **workstation level** checks
- Works towards high **Equipment Efficiency** and **Effective Performance**
- Emphasizes on **operator-ownership**
PROFESSIONAL MAINTENANCE

- **Periodic maintenance** of machine and equipment by skilled professionals
- Aims to increase the time between failures of equipment (MTBF) and reduce repair time (MTTR)
- Prevent losses due to machine breakdowns
QUALITY CONTROL

- Gate keeper for Standards
- From start to finish, ensures products meet customer requirements
- Works towards ZERO Defects
- Ensures customer quality satisfaction
- Utilizes highly specialized tools for analysis and quality assurance
LOGISTICS

Pillar responsible for making parts available

- at the right location
- at the right time
- in the right manner that meets customer requirements

- Safe, efficient and cost effective methods of logistics are vital to any mfg. environment
Based on **experience with existing equipment**, ensure procurement of **new equipment** that are engineered to **meet requirements** for safety, reliability and easy maintenance.

Generate **checklist** items that would be useful for new equipment procurement.
EARLY PRODUCT MANAGEMENT

- Driving design for manufacturability, to make advancements in safety, quality and customer care
- Based on experience with existing product, ensure future designs address concerns and accommodate changes based on customer feedback
- Continuously improving product design for market competence and customer satisfaction
PEOPLE DEVELOPMENT

- Creating **Exceptional** people
- Impart state of the art **training** and **development** to create a strong workforce
- Facilitate **knowledge sharing** and creating **best practices** throughout the journey of continuous improvement
ENVIRONMENT

- Ensuring our responsibility towards the environment and its preservation for future generations
- Continuously pursuing ZERO WASTE philosophy through reuse and recycle mechanisms
- Prevent all Environmentally unsafe acts and conditions throughout the facility
- Create a sense of awareness among other partners
FOUR PHASES OF LOGISTICS

The flow must be short and simple!

Improvement from big movements to small movements gradually.
WCM LOGISTICS

Step 1: Reengineer assembly to satisfy customers
Step 2: Rearrange internal logistics
Step 3: Rearrange external logistics
Step 4: Create a smooth flow
Step 5: Level production
Step 6: Create an accurate flow
Step 7: Integrate sales, distribution, production and purchasing

Adopt a sequence – time fixed scheduling method
PHASE 1: CREATE A FLOW

[Broad standardization and synchronization]

a) Establishment of the concept of overall logistics and design of logistic network. (Customers and suppliers inclusive)

b) Design of external logistics and establishment of routes for scheduled transportation (min. : 1/day). (Fixed time, variable quantity fixed time, fixed quantity)

c) Layout change for internal logistics.

d) Arrangement of the places of products and parts and stores, the ways items are packed. (Container, packaging shape, size, the number of items stored in a container, easiness to identify items)

e) Use of kanbans.

f) Use of the water strider method.
WORK PLACE ORGANIZATION

a) Improvement of assembly line layout (Simplify)
b) Making the assembly line short
c) Leveling daily production
d) Connection of the sublines to the assembly lines.

Putting sub assembly lines into lines as much as possible.

e) Following the pull principle.
TO START:

**3S**

1. Seiri (Abandon the unnecessary)
2. Seiton (Putting things in order)
3. Seiso (Keep tidy and clean)

**5T**

1. Tei-ji
2. Tei-ichi
3. Tei-hyouji
4. Tei-ryou
5. Tei-shoku
SEITON: 5T (TEI-JI, TEI-ICHI, TEI-HYOUJI, TEI-RYOU, TEI-SHOKU)

- **Tei-ji** : Fixed route (where to pass?)
  In order to create a flow of products, information, equipment and/or people

- **Tei-ichi** : Fixed place (where to put?)
  In order to determine the place to put and take things easily, quickly and surely

- **Tei-hyouji** : Standardized display (where is it, what is it, what/how to do?)
  In order to let everybody understand easily places, articles, what/how to do

- **Tei-ryou** : Fixed quality (How much?)
  In order to control quantity of articles

- **Tei-shoku** : Standardized colors (How to distinguish?)
  In order to prevent errors by using colors
Making a flow capable to cope with change

**Logistics**

a) Reorganization of logistics points to shorten the line of logistic flows.

b) Re assessment of “purchase” or “make in-house”.
   Try to produce products of small quantity in-house.

c) Reorganization of stores and level production.

**Work place organization**

A. Improvement of setup operation.
B. Connection of lines. Absorption of smaller lines into the main line.
   Gathering lines. Promotion of mixed production.
C. Creating multi-skilled labor.
D. Integration of lines.
PHASE 3: CREATE AN ACCURATE FLOW

**Logistics**

a) Improvement of the ways items are packed in such a way that parts and products can be put and can be easily picked up and taken out. Making the quantity smaller.

b) Reduction of the size of stores and increase of the number of transportation.

c) Improvement of the accuracy of utilized kanban.

d) More leveling.

**Work place organization**

a) Improvement of the accuracy of SOP. Small, smooth and rhythmical movement

b) Arrangement of the workshop in such a way that any anomaly can be detected immediately.
PHASE 4: CREATE A CONTROL FLOW

Logistics

a) Making a manual for using kanban.

b) Preparation of management data on Q, C and D, especially about root causes.

   Establishment of routine control, anomaly control and control for changes.

c) Management of PM

d) Making texts for education and training and management of personal career history.
STEP 1 INITIAL CLEANING

Sort

Set in Order

Shine

Sustain

Standardize

3PL 5S Audit Scores

90%
80%
70%

Q1 - 2014
Q2 - 2014
Q3 - 2014
Q4 - 2014
Q1 - 2015

26
STEP 1 PLAN FOR EVERY PART

Physicals for Each Part Number

Packaging for Each Part Number

Supermarket Information for Each Part Number

Station Information for Each Part Number
STEP 2 JUST-IN-TIME METHOD

The Production Line Pulls the Material JIT or JIS.
STEP 2 JUST-IN-SEQUENCE METHOD

- Tanks
- Axles
- ROPS JIS From Warehouse
- Tires JIS From Supplier

Supports FIFO!
STEP 2 EKANBAN METHOD

Supports FIFO!

Returnable Tote Filled by Supplier and Stocked to the Supermarket in the Same Container

100 101 101

A B C
STEP 2  EXTERNAL TWO BIN METHOD

792 Class C Part Numbers Delivered by 2 Bin Method

Supports FIFO!
## STEP 3 REARRANGE EXTERNAL LOGISTICS

### 5R’S
- Refuse
- Reduce
- Reuse
- Recycle
- Recover

### Dunnage Reduction

<table>
<thead>
<tr>
<th>Product</th>
<th>Each Corrugated Box weighs 3.5 lbs.</th>
<th>Total Boxes</th>
<th>Total Weight lbs.</th>
<th>Total Pallets Eliminated</th>
<th>Total Urethane Foam</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECI Wiring Harness</td>
<td>3.5</td>
<td>1497</td>
<td>5239.5</td>
<td>94</td>
<td>0</td>
</tr>
<tr>
<td>ECI Wiring Harness</td>
<td>3.5</td>
<td>1357</td>
<td>4749.5</td>
<td>85</td>
<td>0</td>
</tr>
<tr>
<td>Airway Fittings</td>
<td>0.45</td>
<td>12861</td>
<td>5787.45</td>
<td>536</td>
<td>0</td>
</tr>
<tr>
<td>Gates Fittings</td>
<td>0.45</td>
<td>1450</td>
<td>652.5</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>GSK TECH Lap Bars</td>
<td>10</td>
<td>1479</td>
<td>14790</td>
<td>739.5</td>
<td>1479</td>
</tr>
</tbody>
</table>

### Recycled Packaging Material
- **2014:**
  - 241 Tons of Corrugate
  - 590 Tons of Wood
Receiving Docks Distributed Around Plant to Allow Material to be Delivered Close to the Point of Use.

Buckets and Unpainted Parts
# STEP 5 MATERIAL CLASSIFICATION – PLANT WIDE

## Parts Classified by Percentage

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
<th>Sub-class</th>
<th>Sub-group</th>
<th>Examples</th>
<th>Recommended stock level</th>
<th>Recommended flow type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Level 3</td>
<td>Level 4</td>
</tr>
<tr>
<td>A</td>
<td>Expensive items (Upper 50% of BOM &gt; $350)</td>
<td>AA.1</td>
<td>Many variations</td>
<td>Includes all the expensive parts with many variations, bulky or not.</td>
<td>&lt; 2 hrs</td>
<td>&lt; 1 hr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AA.2</td>
<td>Bulky</td>
<td>Includes all the expensive and bulky parts. Without many variations.</td>
<td>&lt; 2 hrs</td>
<td>&lt; 1 hr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AA.3</td>
<td>Other expensive</td>
<td>Includes the rest of expensive parts, not assigned to the previous sub-groups.</td>
<td>&lt; 2 hrs</td>
<td>&lt; 1 hr</td>
</tr>
<tr>
<td>B</td>
<td>Bulky items</td>
<td>AB.1</td>
<td>Many variations</td>
<td>Includes all the bulky parts, with many variations.</td>
<td>&lt; 2 hrs</td>
<td>&lt; 1 hr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AB.2</td>
<td>Other bulky</td>
<td>Includes the rest of bulky parts, not assigned to the previous sub-groups.</td>
<td>&lt; 2 hrs</td>
<td>&lt; 1 hr</td>
</tr>
<tr>
<td>C</td>
<td>Many variations¹</td>
<td>AC</td>
<td></td>
<td></td>
<td>&lt; 2 days</td>
<td>&lt; 1 day</td>
</tr>
<tr>
<td>B</td>
<td>Normal items²</td>
<td>B.1</td>
<td>High consumption</td>
<td></td>
<td>&lt; 2 days</td>
<td>&lt; 1 day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B.2</td>
<td>Low consumption</td>
<td></td>
<td>&lt; 2 hrs</td>
<td>&lt; 1 hr</td>
</tr>
<tr>
<td>C</td>
<td>Small &amp; cheap items</td>
<td>C</td>
<td></td>
<td></td>
<td>&lt; 7 days</td>
<td>&lt; 5 days</td>
</tr>
</tbody>
</table>

## Parts to Pull Logic

- Green: JIT/JIT-Vendor
- Green: Two Bin
- Red: Kanban
- Blue: JIS/JIT-Whse.
STEP 5 JUST-IN-SEQUENCE UPPER CHASSIS CART REFINEMENT

Before

After

NVAA Reduction: -18%
STEP 6 ACCURATE FLOW IN THE MODEL PROCESS

Line Load

Replenishment Tool

Select Units For Next Two Shifts

Pick Only Parts Required

Replenish Only Parts Required

Load into WMS
STEP 6 - INTEGRATION OF DISTRIBUTION

- Project worked with vendor, purchasing, corporate logistics and plant logistics. Lap bars coming from Taiwan

- Lap bars from Taiwan were shipped 2 to a box, reconfigured the layout of the lap bars in the box and increased to 4 pieces per box

- We are reviewing all international suppliers for opportunities to leverage packaging.

- Reduction of 18 ocean containers on average per year for lap bars

- Reduction of 43,128 lbs. CO₂
STEP 6 - INTEGRATION OF DISTRIBUTION

Full container engine deliveries from overseas. Container is live unloaded and the empty container returns to Kansas City, round trip is a cost of $900

Previously 8 containers a month were filled with returnable racks and returned to engine supplier with an additional $900 round trip charge, working with corporate logistics and steamship lines racks are returned on containers that delivered engines

Next phase will involve pulling whole-goods units into the outbound mix.

Projected Savings:
- Transportation $86,000 annually

CO2 Reduction: 349,000 lbs. CO2
# Logistics Tools

<table>
<thead>
<tr>
<th>Reactive</th>
<th>Preventive</th>
<th>Proactive</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Parts classification</td>
<td>11 FIFO</td>
<td>21 QC of incoming materials: phase 8</td>
</tr>
<tr>
<td>2 Logistics cost deployment</td>
<td>12 Phase 2: smooth flow, SMED</td>
<td>22 Phase 3, step 6</td>
</tr>
<tr>
<td>3 phase 1: Creation of a flow, 5T</td>
<td>13 Andon</td>
<td>23 No breakdowns, no defects</td>
</tr>
<tr>
<td>4 Logistics step 1</td>
<td>14 QC of incoming materials: phase 5</td>
<td>24 Phase 4, step 7: controlled flow</td>
</tr>
<tr>
<td>5 Logistics step 2</td>
<td>15 QC of incoming materials: phase 6 &amp; 7</td>
<td>25 Minimum inventory</td>
</tr>
<tr>
<td>6 Separation operation/transport</td>
<td>16 Logistics step 4</td>
<td>26 Purchasing policy @ design stage</td>
</tr>
<tr>
<td>7 Line side stock management</td>
<td>17 JIT and MRP</td>
<td>27 Suppliers’ involvement</td>
</tr>
<tr>
<td>8 Logistics step 3</td>
<td>18 Logistics Step 5</td>
<td>28 VSM</td>
</tr>
<tr>
<td>9 QC stage 1 &amp; 2</td>
<td>19 WPO/LOG cross training</td>
<td>29 SCM</td>
</tr>
<tr>
<td>10 QC stage 3 &amp; 4</td>
<td>20 The way items are packed</td>
<td>30 IPS</td>
</tr>
</tbody>
</table>
HOW CAN THIS FIT THE ENERGY SEGMENT?

- Engage a Process Expert (3PL or Industrial Engineering support)
- Establish a model area
- Perform a Cost Deployment to understand losses
- Pareto losses and drive project activity by highest losses
- Standardize packaging wherever possible, this includes size and quantity
- Incorporate and Standardize visual management
- Implement minimum material handling concepts
- Standardize put away and picking processes
- Continually drive to 0 human errors
Thank You.