Transformation towards Manufacturing Excellence Practices

Ashokleyland Nissan Vehicles Limited, Chennai

AMS - 2013
About the Company,

Ashok Leyland Nissan Joint Ventures

Joint Venture company between Ashokleyland Limited, a flag ship company of Hinduja Group and Nissan Motor Co, Japan to produce Light Commercial Vehicles in India
About Ashok Leyland:

- Ashok Leyland., one of our principles company.,
  - Founded in 1948 as Ashok Motors
  - Became ‘Ashok Leyland’ in 1955 with equity participation from Leyland Motors, UK
- Touching lives of millions across worldwide
- One of India’s largest commercial vehicle manufacturers
**Ashok Leyland, one of our principle company**

<table>
<thead>
<tr>
<th>LCVs</th>
<th>M&amp;HCV</th>
<th>Defence Mobility</th>
<th>Construction equipment</th>
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<tbody>
<tr>
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</tbody>
</table>

- **Foundry Business**
- **Engines, Gensets and Components Business**
- **Engineering Manufacturing and Enterprise Services**
Nissan Motor Co, one of our principle company

**Nissan Motor Company Ltd**, a Japanese multinational automaker headquartered in Japan.

- Founded in 1911 as “The Kwaishinsha Motor Car Works”
- Become “Nissan Motor Co” as separate entity in 1934

Map showing NMCo Locations

- **Nissan Plants**
- **New Plants** started in 2010
Ashokleyland **Nissan** Joint Venture
Product Launch Milestones

- **2011** DOstell
- **2012** EVALIA
- **2013** STiLE
- **2014** PARTNER
### Products Portfolio:

<table>
<thead>
<tr>
<th>Details</th>
<th>DOST</th>
<th>Evalia</th>
<th>STiLE</th>
<th>PARTNER</th>
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<tbody>
<tr>
<td>Type</td>
<td>1.25T-Truck</td>
<td>7 Seater</td>
<td>8 Seater</td>
<td>6.0T-Truck</td>
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<td>Capacity</td>
<td>55 hp</td>
<td>85 hp</td>
<td>75 hp</td>
<td>120 hp</td>
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<tr>
<td>Cylinders</td>
<td>03</td>
<td>03</td>
<td>03</td>
<td>04</td>
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<tr>
<td>Engine Type</td>
<td>TDCR</td>
<td>CRDI</td>
<td>CRDI</td>
<td>CRDI</td>
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<tr>
<td>Emission Level</td>
<td>BS3/BS4</td>
<td>BS4</td>
<td>BS4</td>
<td>BS3/BS4</td>
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<tr>
<td>Variants</td>
<td>LE/LS/LX</td>
<td>XE/XE+/XL/XV</td>
<td>LE/LS/LX</td>
<td>LS/LX</td>
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</table>

**Manufacturing units:** Hosur & Oragadam, Tamilnadu, India
Automotive Industry – Trends
# Automotive Industry – Trends

## Transformation towards Manufacturing Excellence Practices

- **The Concept of this session**

### Globalisation
- Product portfolio
- Market opportunities
- Joint ventures
- Strategic partners

### Optimizing Cost
- Production Efficiency (Operational, OEE etc)
- Prodn Parts, Aggregate Consumable
- Mfg Cost (Energy, R&M, Manpower, Logistics etc)
- Other Overheads

### Technology Transformation
- Product Design
- Resources sharing (Cloud Concepts)
- Lean Prodn Systems
- Flexible Mfg Lines

### Standardization
- Module design
- Sustainability in Quality
- Standard Parts
- Generalized Systems across plants
- Standard design in Controls & Automation

### New Variants
- Dynamic demands
- Customer Needs
- Segment attraction
- Effective utilization of available resources

### Design to Delivery
- One Platform
- More product
- NPD time
- Virtual Validation
- RPT Critical
- Efficient Mfg planning & Implementation
Transformation towards Manufacturing Excellence Practices

Sub Sets of Concept Note

- Safety
- Productivity
- Environment
- Efficiency
- Morale
- Cost
- Quality
- Delivery

Transformation towards Manufacturing Excellence
Case studies from,

- Stamping
- Weld
- Paint
- TCF
<table>
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<th>Process</th>
<th>Description</th>
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<td>Ergonomics Study &amp; Low Cost Automation</td>
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<tr>
<td>2</td>
<td>Weld</td>
<td>Auto Gun spots for Operational Efficiency improvement</td>
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<td>3</td>
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<td>Implementing Spot Welding Instead of Co2 Welding</td>
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<td>4</td>
<td>Weld</td>
<td>Poka Yoke System for handing variants-Electrical</td>
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<td>5</td>
<td>Weld</td>
<td>Poka Yoke System for handing variants-Pneumatic</td>
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<td>Work Station concept using lean design</td>
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<td>7</td>
<td>Weld</td>
<td>Line Simulation by using Event Simulation Tool</td>
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<td>Gun simulation by using process engg tool</td>
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<td>Paint</td>
<td>Production Monitoring &amp; Efficiency Improvement</td>
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<td>14</td>
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<td>Logistic Simulation by using Event Simulation Tool</td>
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Stamping Line
Ergonomics Study & Low Cost Automation

Case Study:
Ergonomic handling of multi model doors of different size, shape, weight and with different input process is a challenge in the hemming process.

A study had been conducted to improve multi model door handling in an effective manner.

Solution:
A semi automated conveyor with customized design to handle multi model door profile is introduced.

Operations and cycle time validation done through simulation study before Mfg.

Benefits:
- Convenience in Handling.
- Cycle time reduction
- Rejection ratio reduced
Weld Line

- Automation Concepts
- Simulation Concepts
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Weld Line

a) Automation Concepts
Auto Gun spots for Operational Efficiency improvement

Case study:

Truck cabin Roof area welding improvement study.

Challenges.,

- Cabin working height
- Weld Gun handling ergonomics & Spot weld Quality
- Cycle time

Solution:

Auto Gun designed to perform weld spot in the high level area to reach the complexity area.

Gun approach & movement digitally validated

Benefits :

- Safety during weld operation
- Cycle time reduction
- Weld Quality improved
Auto Gun spots for Operational Efficiency improvement

Case study:
- Cabin working level is high.
- Weld Gun handling ergonomics.
- Cycle time
- Weld quality improvement (Edge Spot, Spot Miss, Wrong Location etc)

Solution:

Auto Gun designed to perform weld spot in the high level area to reach the complexity area.

Gun approach & movement digitally validated

Benefits:
- Safety during weld operation, Cycle time reduction, Weld Quality improved
Auto Gun spots for Operational Efficiency improvement

Case study
- Cabin working level very low.
- Weld Gun handling ergonomics.
- Cycle time
- Weld quality improvement
  (Edge Spot, Spot Miss, Wrong Location etc)

Solution:

Auto Gun designed to perform weld spot in the high level area to reach the complexity area.

Gun approach & movement digitally validated

Benefits:
- Safety during weld operation, Cycle time reduction, Weld Quality improved
Implementing Spot Welding Instead of Co2 Welding

Case Study:

Reducing Work content and Cost at Metal line by introducing spot weld instead of Co2 Welding

Challenges:

- CO2 welding creates more gaps and these gaps leads to shower test failures
- Post CO2 weld, Mallet operation is required to reduce gaps
- Grinding and Sanding operations are required to make smooth surface at Co2 Welding area
- Required Skill Operator to perform the process
Benefits:

- Eliminations of high fume creation.
- Elimination of Malleting, Grinding & Sanding operations
- Optimization of manpower
- Shower test result improvement
Using Poka Yoke Systems for Variants Handling
Two New Brackets added in Brkt assy 2\textsuperscript{nd} Seat Mtg for Seat Variant which is introduced newly.

New Clamp unit with Proxi Sensor was provided in Rear Floor welding jig, to mount & identify the brkts for Seat variant. Hence Both Variants can be produced on the same Jig with help of electrical poka yoke system without mistakes.
Variant 1: Specific.

New brackets in roof bows.

#3 Mechanical Limit Switches was provided, to identify the new brkt’s(3-Nos) for Variant 2. Hence both Variants can be produced on the same Jig with help of pneumatic poka yoke system.
Weld Line

b) Simulation Concepts
Weld Work Station concept using lean design :-

Case Study :
Lean Steps: (By Using Process Engg Tool)

- Gun Simulation for Optimizing Weld Guns (3D Fixtures, Prod Data, Gun Library)
- Ergo Simulation for the Operator fatigue and Approach (3D Man Profile like Indian etc)
- Station Optimization for reduction of work area space and Operator walking (Detailed 2D Layout with Fixture, Trolley, Tools, Equipments & To convert 3D)

Results:

- Three different assy are in Single Zone (i.e. Roof Assy, BP Assy, FP Assy)
- Reduction in no of operators
- Reduction in no of Weld guns

Benefits:

- Man power expenses Reduction
- Effective Utilization of Equipment
- Optimum Space Utilization
- Effective allocation of operators
- Cycle time reduction due to reduction of Operator movement
Weld Line Simulation by using Event Simulation Tool

Approaching Stages:
- Detailed study of processes and station plans
- Arriving at multiple layout plans.
- Development of 3D digital model of plant
- Analysis of stations, distance, trolley positions, trolley movement route, station operation time, operator details and material routes

Deliverables:
- Effective utilisation of storage space
- Production capacity improvement
- Optimum Line side inventory

Benefits:
- Increased storage space utilization of 40%
- Production capacity improvised by 30%
- Forklift quantity reduced by 25%
Case Study:

- Commonization of Weld Guns Specs between Old line and New Line
- Optimize No of Weld Guns
- Reduce Consumable inventory in the plant

Solution:

- Get Gun Profile from existing Line data
- Simulate for Common Gun Spec for different Sub Assy

Benefits:

- Lesser Inventory Cost
- Better Maintenance
- Lesser Time for Replacement
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Paint Line

a) Automation Concepts
b) Simulation Concepts
Paint Line

a) Automation Concepts
Case Study:

Cabin location tracking in Paint Shop is a critical activity which helps to identify the bottlenecks and to increase productivity.

Solution:

One of the smart way of tracking method is by using the RFID Tags which is fixed on the cabin before the process and will be removed finally.

Advantages:

- Cabin body locating made easy
- Production Output can be monitored on real time basis
- Analytics application provides the analysis of the sequence change of the cabin with in a particular time interval and emails the data to the user in the form of an MS Excel sheet.
Production Monitoring & Efficiency Improvement
Benefits:

- Reliable Identification of the cab from weld line to chassis line continuously through 3 shop floors without changing the RFID TAG.
- One identification throughout his shop floor reduces his inventory cost.
- Automatic updation of the information from the shop floor directly to the ERP system.
Paint Process Line Operational Efficiency monitoring is an important performance parameter in paint shop which decides the Paint Shop throughout capacity and effective utilization of the system.

Problems:

- Stoppages of Hangers, Skids.
- Maintenance Issues
- Manual intervention for reset
- Communication Failures
- Difficulty in accounting production losses
Solution:

An online monitoring of the Hangers, Skids movement on real time basis is suggested to address the problems.

Results:

After the implementation of the SCADA System monitoring, each hangers performance is monitored and cycle time Set Vs Actual is verified for each rounds. Line stoppage is reduced and reasons are identified.

<table>
<thead>
<tr>
<th>Cycle time Set</th>
<th>Alarm Pages</th>
<th>Analysis of Hangers</th>
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<tbody>
<tr>
<td>Process Line</td>
<td></td>
<td>Operational Efficiency monitoring</td>
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Case Study:

Wax application is an critical stage stage in paint shop after topcoat painting.

Based on the application areas, box sections, long members, channels - the no of stages will be decided and manpower deployed.

As an improvement initiative, the auto waxing system is proposed to optimize the wax booth stages and work content.
Solution:

Study conducted on the product profile and wax application points. To begin with, the sill panel area wax application is automated using horizontal reciprocators, proximities and wax spray nozzles.

Benefits:

- Wax process cycle time reduction
- Work content optimization
- Man power optimization
Paint Line

b) Simulation Concepts
Case Study:

To attain maximized capacity by effective utilization of available resources in paint shop

Inputs required for simulation:

- Shop layout
- Conveyor parameters
- Process parameters
- Rejection / re-work conditions

Solution:

- Simulate paint shop layout
- Define the optimal operational condition
- No. of skids
- Conveyor speed
- Buffer loop capacity
Results:

- Cycle time optimization
  (Degrease, Rinse, Phosphating, ED, UF Stages, etc)

- Process time reduction
  (Masking, Sealing, RPP, TC etc)

- Optimum Conveyor speed settings
  (P&F, EMS, Chain Conveyors etc)

- Optimum No of Skids, Hangers
  (WBS, PT/ED, Paint)

- Buffer Storages
  (WBS/ED/SLG/PRIMER/TC/PBS)

Capacity analysis using Event Simulation Tool
TCF Line

a) Process Engg Concepts
b) Simulation Concepts
Case Study:

MBDA to be decided for facility & process planning

Solution:

Process Engineering tool was used to analyze the buy level conditions within a CFT team of Mfg, Sourcing, Quality, SCM, PD etc.

Benefits:

- Decision on Modular assemblies at early stage of planning.
- In-house cost reduction (Space, Manpower etc)
- Process planning updates were made easily
S BOM & M BOM Creation by using Process Engineering Tool

**Product Data Inputs:**
- CAD BOM with 3D Data
- Attributes

**Other Data Inputs:**
- Release Date
- Implementation Date
- Stage
- Application
- Master Part List (Which Contains all Parts Information List (Part No, Part Name, Level Qty. etc.))
- ECN

**PE:**
- Creation of process activity:
  - Assign parts to processes
  - Assign sub assy / group part no to processes.

**S-BOM** → **M-BOM** → **Process structure creation**
- Categorizing of parts into:
  - Buy
  - Consumables
  - Procurement Sub assy level creation
  - Group part no. creation
  - In-house

**Process activity to process structure**

**Factory layout & Supply area assignment**

**Output to SAP**
S BOM & M BOM Creation by using Process Engineering Tool

**SBOM**
- Gather Input required for SBOM
- Flag Make/Buy
- Create Phantom
- EOP when all line items are flagged. Visual validation to confirm completion.

**Process Planning**
- Get all the inputs for Process Plan
- Detail Operation (process sequence and other)
- Perform Basic MOST analysis and Line Balancing

**MBOM**
- Plan and Prepare
- add parts to the kit considering
- Perform Visual Validation

**Factory Layout**
- Link MBOM Item to Process
- Create factory layout and link
- Generate all outputs to SAP
S BOM & M BOM Creation by using Process Engineering Tool

**EBOM to SBOM Creator Window**

**SBOM Creation**

**Assigning parts from SBOM to MBOM (Process tree)**

**Operation sheet output**
b) Simulation Concepts
Objective:
- Optimize Layout & Logistics to meet cycle time
- To work out material movement distance (mts) from truck receipt to store & store to line side feeding
- Stores inventory level variation across day based on variable truck arrival assumptions as per various truck part mixes
- Identify bottle-neck station with respect to material feed

Simulation Screen Shots
Logistic Simulation by using Event Simulation Tool

Inputs required:

- CAB manufacturing bill
- Station details –
  - Part sequence
  - Times – load, operation & unload time
  - Container / bin – part, qty and size
  - Rack details – Size and capacity
- Store & TCF line layout
- CAB models in 3D
- Truck arrival sequence & container part configuration
- Logistics material handling details –
  - Truck unloader (Human)
  - Dock to Store (Tow truck) - capacity, speed
  - Store to line (Tow truck) – capacity, speed
  - Subassy to Line (Push Trolley) – capacity, speed
- Truck unloading time
- Shift timings
- Production Volume
Logistic Simulation by using Event Simulation Tool

**Deliverables:**

- TCF line throughput time
- Area Analysis (No. of trolleys required for each part & space for trolleys in Sq.mts)
  - Store area
  - Empty trolley area
  - Dock
  - Line side
- Material Handling Analysis (Qty & Utilization)
  - Truck Unloader
  - Tow truck
  - Sub Assy - Push trolley
- Part trolley replenishment plan (store to line and sub Assy to line) – No. of replenishment per shift for each part
- Part logistics analysis (distance travelled by each part trolley in mts – Dock to Store to Line)

**Benefits:**

- Increased storage space utilization
- Forklift quantity reduction
- Optimization of Line side inventory level
Transformation towards Manufacturing Excellence Practices

The Drive Continues..,
Thank You

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