New Flyer Lean Manufacturing Journey - Agenda

- About New Flyer
  - History
  - Market
  - Products
  - Facilities
  - Processes

- OpEX - Lean Manufacturing at New Flyer
  - What is Lean
  - Lean Tools
  - Foundational Tools
  - JIT Tools
  - Jidoka (Quality) Tools

- Benefits of Lean at New Flyer

- Closing Thoughts
New Flyer History

- Founded 1930 in Winnipeg as a 5 person operation
- Company has grown to an international organization of approximately 3200 people.
- St. Cloud plant built in 1999 – 380,000 sq.ft.
  - Expanded by 20,000 sq.ft. last year
- In 2013 New Flyer purchased parts business from competitor Orion
- In 2013 New Flyer purchased its number three competitor NABI
- In 2014 started production of MiDi (partnership with Alexander Dennis)
New Flyer Today

- Largest metro-transit bus builder in North America
- 3200 Employees in North America
- New Flyer has 50% share of the North American Market for metro transit buses
- 1 out of 5 metro buses in North America are New Flyer
New Flyer Products

- Xcelsior - Heavy Duty Transit Buses
  - 35 foot, 40 foot and 60 foot Articulated
  - Clean Diesel
  - D/E Hybrids
  - CNG
  - All Electric
  - *Hydrogen Fuel Cell*

- MiDi – New Product
  - European Design - Alexander Dennis
  - 30' and 35'
Manufacturing Facilities

Winnipeg, Manitoba
447,000 sq.ft.
1200 Employees
Frame build through shell
Parts manufacturing

Crookston, Minnesota
116,000 sq.ft.
300 employees
Shell through finished bus
Manufacturing Facilities

Ontario, California
103,000 sq.ft.
50 employees
LA Metro

Aniston, Alabama – NABI
464,000 sq.ft.
St. Cloud MN Facility

- 400,000 square feet of manufacturing space
- On 75 acre campus
- Plant built in 1999
- Complete Assembly Facility
  - Weld – Assemble - Customer Acceptance

- Currently building 24 buses per week on two shifts
  - Increased production line rate from 18 to 24 units per week.
  - Takt time from 4.44 hours to 3.33 hours

- Grown employment from 450 to 768 in last two years (318 new jobs)
St. Cloud Plant Flow
Production steps

Interior Flooring

Exterior

Welding

Corrosion
Production Steps - Painting
Production Steps – Engine Prep & Install
Production Steps - Electrical Check Out
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Lean Manufacturing at New Flyer
What is Lean Manufacturing?

- Lean manufacturing is a Strategic Weapon to use against our competition to gain market share
- Elimination of waste:
  - Motion, Space, Effort, Materials, Defects
- A journey not a destination
  - About striving for perfection
- Multiple components or tools that work together
- About Flow: Smoothing the Flow
  - Flow of information, materials, product
- About planning, execution, processes
  - Process that are capable of predictable outputs
What is Lean Manufacturing?

Lean Manufacturing is:
- About learning
- Continuous improvement
- Teamwork
- Solving problems
- Participation and employee involvement
The Toyota Lean House

Goal: Highest Quality, Lowest Cost, Shortest Lead Time

Just-in-Time
- Continuous Flow
- Takt Time
- Pull System

Jidoka
- Stop and notify of abnormalities
- Separate man’s work & machine’s work

Heijunka

Standardized Work

Kaizen

Stability

Toyota Production System "House"
# Lean Manufacturing Tool Box

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**In Sourcing**
- Level Loading (Heijunka)
- Standardized Work Visual Controls
- Management Commitment Kaizen
- Work Cells
- Cross training

**Others**
- 5S
- Design for Manufacturability & Assembly
- TOC Kaizen
- Failure Modes & Effect Analysis
- Point of Use Inventory
- Takt Time
- Management Commitment
- Work Cells
Lean Foundation - 5S

Before

After
Lean Foundation - 5S – Visual Factory - Safety

- Safety-227 Hose Reels and 120 Cord Reels

Before

After
Lean Foundation - 5S - Access to tools

300 Shadow Boards

43 Shadow Carts
Lean Foundation - 5S – Visual Factory

Before

After
Lean Foundation - 5S – Visual Factory

➢ Water Test Curtains

Before

After
Lean Foundation - 5S – Visual Factory - Signage
Lean Foundation - 5S - Office

Before

After
Weekly and Monthly Audits
- 85 Plant areas/stations & 89 offices
- 115 Trained Auditors

Posted on Visibility Boards
Re-Audit Process
Reported at Operations Mtg.
Lean Foundation - Work Cells

Before

After
Lean Foundation - Work Cells - Communication

Performance metrics posted on visibility boards

Daily cell huddles
Lean Foundation - Work Cell - Communication – iBus intranet site
Lean Foundation - Work Cell - Communication – LiveBus Data Tracking

Before

After
5S – Visual Factory

Vending Machines

Cell Pods

LiveBus

Shadow Boards

Painted Floors

Visibility Boards

Everything in its Place
13) Apply stitch weld at the center support and continue along the bottom edge of the center tube. When you reach the corner, stitch welding down along the inside edge of the left tube. Finish by welding the corner of the gusset plate to the ring.

13.1) Note the sequence and position of the stitch welds on the gusset plate.
Lean Foundation - Kaizen

- We have used the Kaizen approach in our Lean manufacturing Implementation.
- Value Stream Mapping Kaizens starting in 2011
Lean Foundation - Kaizen – Value Stream Mapping

- Started Q4 2010
- Completed 67 projects to date
Lean Foundation - Lean Training

- New Flyer Institute
  - Math & Measurement
  - Blue Print Reading
  - Hand tools
  - Harness and connector
  - Sika Sealant
- Lean 101
- 5S
- A3
- Lean Yellow Belt
- Green Belt
- Black Belt
Lean Foundation - Lean Green Belt Army

Rob Marion  Kelly Beckman  Stan Voas  Jim Tingley  Jay Picklyk  Steve Gault

Geff Magsam  Joel Galang  Anna Rabinovich Bursak  Mike Janik  Eric Jensen  Nonito Legaspi

Jeff Heuring  Roger Finger  Tony Rolfes  Marilena Demchuk  Jessie Nacar  Pauly Davies

Eric Birir  Scott Simpson  Roger Foliente  Nerisa Galang  Rich Avelsgard  Chris Hoffman
Lean Manufacturing Tool Box

**TOC**
Single Piece Flow
Kanban
Set Up Reduction (Quick Changeovers or SMED)
Takt Time
Flow
Point of Use
Inventory
Andon

**In Sourcing**
Level Loading (Heijunka)

**Jidoka** (autonomation, built-in quality)
TQM (Total Quality Mgmt)
Failure Modes & Effect Analysis
A3 Problem Solving
6 Sigma

**Pull Production**
Poka-Yoke (mistake proofing)
Design for Manufacturability & Assembly
TPM (Total Productive Maintenance)

**5S**

**Standardized Work Visual Controls**

**Management Commitment Kaizen**

**Work Cells**
Cross training
JIT - Point Of Use

Before

After
JIT - Point of Use

Before

1. Delivery truck arrives on site
2. Parts are received
3. Parts are shelved
4. Parts are stored
5. Parts are picked for production
6. Parts are sent to production
7. Parts are available for production

After

1. Delivery truck arrives on site
2. Parts are received
3. Parts are available for production
JIT - Pull Systems - Kanban
JIT - Single Piece Flow

- Waste Eliminated – Sub Assembly department broke up and placed line-side at the install stations.

Before

After
JIT - Insourcing

- Extrusion Machining
- Axle Bunk Welding
- Roof Top Frame Welding
JIT - Andon Lights
# Lean Manufacturing Tool Box

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- Point of Use Inventory
- Andon

**Flow**
- Level Loading (Heijunka)
- 5S

**In Sourcing**
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**Jidoka - Quality at the Source**

- There is an important relationship between Quality (Jidoka) and Lean (JIT)
  - You can’t do one without the other

- Three simple steps to quality:
  - Define how good is good
  - Design processes that are capable – CpK
  - Keep the process in control

- Six Sigma = 6σ
Jidoka - A3 Problem Solving

- An A3 is a one page (11” x 17”) Problem Solving method
  - Gets people involved
  - Standardizes on a simple process
  - Process based solutions

- Tells the story on one page.
- Drives root cause analysis

- There are 81 Cell Team Members trained to lead A3 projects.
- 47 projects have been completed to date (21 months) yielding $480K in savings
- 27 more projects are currently in process with $282K potential savings
We started our A3 program in SCL in March of 2013.
To date we have successfully completed 31 A3 projects.
9 of these 31 projects had estimated cost savings totaling $128K.
There are currently 29 Open (In Process) A3 projects in SCL
23 of these have estimated cost savings potential totaling $527K.
Jidoka - Total Productive Maintenance
Continuous Improvement - OpEx

- LiveTicker
- Master Facilities Plan
- Engineering Quality
- Advanced Quality Planning
- Capacity Planning Improvements
- In-House MRB Reduction
- Risk Review On Upcoming Contracts
- Bus Standardization Update
- Change Control Board
- Set Up Reduction Plan
- Paint Improvements
- Cell Re-Alignment
- Manufacturing Readiness Assessment
- Quality Standards Update
- Supplier Performance and Quality
- Cost Reductions
- HR Module Implementation
- The Name Goes On When We Are Proud of the Bus
- Live QA
- Live Labour Planning
- Cell Leader Development
- Value Stream Mapping Plan
- Training Institute Established
- Product Lifecycle Management
- Live Bus
- Bid Group Established
- In-Sourcing/Repatriation of Work
- Work Cell Pods Established
- Quality Restructuring
- Facility Upgrades
- Freight Optimization
- Bus
- CPM Team Restructured
- SS
- Plant Clean Up Events
- Weekly Cell Metrics Meetings
- MRO Vending
- Inventory Org Reorganization
- Supplier
- Work Cells Established
- Business Systems Group
- Automated SRCRs/Price Changes
- Daily Huddles/Visibility Boards
- Sourcing Group Restructured
Lean Assessment

- Annual Lean Assessment
- Outside independent assessor
- Canadian Manufacturers & Exporters
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Benefits of Lean for New Flyer

What has Lean Manufacturing done for New Flyer?

- Safety
- Inventory
- Efficiency
- Build in Station
- WIP
Corporate OHSA Rate History
Occurences per 200,000 Hours Worked

Lean Manufacturing Journey
Inventory

TOTAL INVENTORY ALL 3 PLANTS

PRE-BUY

TOTAL $$
Productivity

Corporate Average BIS, Efficiency & Overtime

- BIS: 87%, 90%, 94%, 95%
- Efficiency: 80%, 80%, 85%, 85%, 89%
- Overtime: 12%, 6%, 5%, 11%, 7%
Work in Process

Corporate Quarter Ending WIP (units)
Closing Thoughts

- We are surrounded by Waste (opportunity)
- Lean works best when more tools are used together.
- However to get started need to start with one.
  - 5S  VSM  Six Sigma  TOC
- Must have Top Management Commitment and understanding.
- Get people involved
- Transparency is Key
  - You cant fix what you cant see.
- Must use teamwork
Thank You

What Questions do you have?