"Best in Class Integrated LeanSigma Case Studies",

- Center and Program Overview
- Healthcare: OSU Medical Center and Ohio Health
- Production: Mettler Toledo
- Supply Chain: OSU PRSM
Purpose, Objectives, Agenda

**Purpose:** Showcase a sampling of the great Integrated LeanSigma Capstone Certification projects from this past year in ISE at Ohio State.

**Objectives:**
- Quick get to know us and the program in ISE at OSU
- iSixSigma Final Tollgate Style Presentation on four Projects
- Spark dialogue

**Key Points:**
1. what’s the business and system/process and problem
2. What was it like when we started?
3. What was it like when we finished?
4. Highlights of how we got FROM (initial state) to TO (desired state)
5. Insights, learnings, what’s next for me
About Scott—Career Milestones and Experiences

Education and Professional Experience

• The Ohio State University, BSISE, 1973
• Eastman Kodak, Service Systems Engineer, 1973-1975
• The Ohio State University, MSISE and Ph.D., 1978
• Oklahoma State University, Associate Professor, 1978-1984
• Virginia Tech, Full Professor, 1984-1997
• Executive Consultant for/with David Poirier at Loblaw, HBC, Noske Kaeser, Sears Canada (1991-2012)
About the Program in ISE at OSU

- Key Facts
- Roadmaps trained and Alignment to ISE Core and Tracks
- Design Strategy (Bloom’s taxonomy) and Training Materials Utilized
- Focus on Creation of Value
- Focus on ISE/ILSS + O4D balance (Change Management)
- Focus on solid Program and Project Management practice and skill development
- Increasing focus on Analytics
- Program Outcomes
Key Facts About the Program in ISE at OSU

1. Initiated in 2007 (Julie Higle was champion, I designed and developed it)
2. 260 Candidates have completed the ILSS Black Belt Foundation Course
3. Covers both DMAIC and DCDOV Roadmaps
4. Average 25 Certification Projects a year, 86 certified Green Belts (16 this year, ~ 70% success rate) and 4 certified Black Belts
5. $2.8M in Direct/Indirect Benefits (audited), $1.2M in D/I Benefits (in audit phase)
6. Written up in the IE Magazine twice and Awarded Innovation Award by IIE in 2011.
Program Featured in 2009 and then in December 2013 in IE Magazine
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Integrated Lean and Six Sigma:

The disciplined use of data, facts and ISE principles and methods to improve the effectiveness, quality, efficiency, and productivity of key processes in organizations.
**Integrated LeanSigma Program at Ohio State**

**Integrated LeanSigma Certification Program**
- Integrated LeanSigma Foundations Course
- Integrated LeanSigma Capstone Certification Project

**ISE Focus Tracks**
- Management Systems and Operations Research
- Data Analytics and Optimization
- Manufacturing
- Human Systems Integration and Design

**ISE Core Curriculum**
- Linear & Non-Linear Programming
- Design of Work
- Ergonomics & Cognitive Engineering
- Manufacturing Engineering
- Project Management
- Quality Control & DOE
- Production Planning
- Stochastic Modeling & Simulation

**General Engineering Curriculum**

**ILS Foundations Course**
- Blended Training Model
- 2 Full Day Hands on Learning Labs in Lean and Six Sigma
- 2 day lab on change leadership & management
- Five week capstone Lab (Sigma Brew)
- Moresteam Curriculum
- Minitab as analytic support

**Capstone Certification Project**
- Green Belt Project (28 wks)
- Yellow Belt Project (14 wks)
- Paired with local company sponsor
- Integrated with Change Leadership & Management
- must create improved process capability, proof of, to gain certification
Lean Sigma Foundations

Your course learning resources

MoreSteam University

The Lean Six Sigma Pocket Toolbook

The Fifth Discipline

Lean Six Sigma & Minitab

Minitab 16 Statistical Software

Our new release makes analyzing your data easier than ever. Perpetual and introductory versions available for purchase now by students and instructors.

Buy or Rent from $29.99 USD.
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The way Bloom’s Taxonomy plays out is shown below....
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Emphasis on them understanding how ILSS fits in the growth of Franchise Value

**POSITIONING STRATEGY**

Increase Franchise Potential

Geographic Coverage / Offerings Provided / Served Segments / Etc.

**RESOURCE ALLOCATION**

Optimize Relationship Investments
(Appropriate / Adequate / Efficient / Effective)

Value Exchange Management

**EXECUTION**

Improve Investment Delivery
(Flexibility / Cost / Quality)

Productivity / Quality / Capability & Capacity / Consistency / Efficiency / Global Competitiveness
They have to translate this to their project and it looks like next slide, as example.
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Greatness is a lot about disciplined people (thought, word, deed)—Jim Collins

Disciplined about what?—Peter Senge

ISE: Systems & Statistical Thinking

- Personal Mastery
- Mental Models
- Building Shared Visions
- Team Learning
Performance = f (…….)

**Mindset:**
- Willingness
- Intention
- Focus
- Attitude
- Values & Ground Rules

**Capability:**
- Knowledge/ability
- Skill
- Competence
- Experience
- (IQ) Intelligence

**Effort:**
- Level of Effort
- Efficiency
- Productivity
- Quality of Effort
- Preparedness

**Attributes:**
- ‘connectivity’
- Relationship management
- Servant mentality
- Listening skills
- Commitment to serve higher good
- Consciousness
- Astuteness
- Image, positioning, likeability
- EI (Emotional Intelligence)

**Performance:**
- **Personal outcome** (e.g. grade, bonus, raise, assignment quality, etc.)
- **Output** (deliverables)
- **Productivity** (output/input)
- **Effectiveness** (doing right things)
- **Results** (process capability improved, efficiency up, capacity improved, productivity up, etc.)
- **Impact** (Profit and Loss statement impacted positively, balance sheet improved, franchise value growth)
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Program and Project Management Big Component and Emphasis

- An event-driven plan for executing the program

- Not a calendar based plan
- Becomes a contractual document (or Commitment in our case)
The Way the IMP Works!

Event (Sig Accomp.)

Event readiness or completion provides a measure of progress

Supporting Accomplishments

Usually there are multiple supporting accomplishments for each event

Supporting Criteria

Usually there are multiple supporting criteria for each accomplishment

First Flight Readiness Review Complete

First Flight!

• SEEK EAGLE Flight Clearance Granted
Simple Overview of the IMP/IMS Relationship

- **EVENT based Plan**
- **“Contractual” document**
- **Relatively top level**

**INTEGRATED MASTER PLAN (IMP)**

**INTEGRATED MASTER SCHEDULE (IMS)**

- **TASK & calendar based Schedule**
- **Level of detail necessary for day-to-day execution**
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An Analytics Component is increasingly an integral element and focus

- Data selection / gathering
  - Find the data you need

- Cleaning
  - Assure the data quality – 2103, 3013, ...

- Integration
  - Assure these data can be joined with those other data

- Storage
  - Make sure the data are stored where you can get at them & use them

- This already looks like a full-time role, and we haven’t even started analyzing anything yet ...

- In the craft process, one analyst is responsible for all aspects above
- Generally, analyses will be great, but they will have long cycle times

S. Cunningham; Intel Corporation; 2013
I think some above the line stuff comes first and then it helps you with Measurement Plans and MSA—applying business acumen in particular.

- **Foundational data role**
  - Select and gather data from many sources, preferably through automated extract, transfer, & load (ET&L) process
  - Assure data are cleaned & ready for analysts to use – data quality monitors
  - Assure data are integrated & can be joined with other data – think LEGOs
  - Assure data storage is high reliability & user-friendly – SSAS cubes, databases

- **“Above the line” analyst role**
  - Extract features from data through statistical analyses
  - Apply business acumen to data & analyses – create new knowledge
  - Apply data visualization techniques to aid in telling the right story – as in life, so in business: the best story wins ...

- In the current state process, we split data and analytics
- Data are stored in a common place, and are trusted and available

S. Cunningham; Intel Corporation; 2013
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Program Outcomes
PROGRAM OUTCOMES: 97+% of the ~190 (since 2007) candidates in the Integrated LeanSigma Option get jobs before graduation
PROGRAM OUTCOMES: 31 Candidates/Projects this year with 21 Sponsors. $1M in D/I Benefits in Audit Phase from these projects just this year.
Program utilizes TRACtion for Program and Project Tracking and Evaluation

### My Projects

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Project ID</th>
<th>Team Leader</th>
<th>WhoisActive</th>
<th>Status</th>
<th>Business Unit</th>
<th>Roadmap</th>
<th>Phase</th>
<th>Date</th>
<th>On Time</th>
<th>Sponsoring Company</th>
<th>Plan Savings $</th>
<th>Actual Savings $</th>
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<tbody>
<tr>
<td>Ohio Health - Lean Neighborhood Care Imaging</td>
<td>329-68331</td>
<td>Andrew Vierholt (348529)</td>
<td>Active</td>
<td>All</td>
<td>DMAIC Control</td>
<td>04/02/14</td>
<td>LATE</td>
<td></td>
<td></td>
<td>OhioHealth</td>
<td>30,000</td>
<td>70,000</td>
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<td>Non-Value-Added Time in the Pack, Pack and Ship Operations</td>
<td>329-68013</td>
<td>Brian Cooper (343793)</td>
<td>Active</td>
<td>N/A</td>
<td>DMAIC Central</td>
<td>04/02/14</td>
<td>LATE</td>
<td></td>
<td></td>
<td>Mettler Toledo</td>
<td>80,000</td>
<td>0</td>
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<tr>
<td>Eliminate Waste in Quality Records Setup Process</td>
<td>329-68010</td>
<td>Yu Xu (391065)</td>
<td>Active</td>
<td>N/A</td>
<td>DCOV Verify</td>
<td>04/08/14</td>
<td>LATE</td>
<td></td>
<td></td>
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<tr>
<td>Improving the integrity of the Resistance Measurement System after Production Line 2</td>
<td>329-70658</td>
<td>Michael Newlin (351520)</td>
<td>Active</td>
<td>All</td>
<td>DCOV Optimize</td>
<td>04/04/14</td>
<td>LATE</td>
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<td>Decrease turnaround time for portable surface CCP</td>
<td>329-68209</td>
<td>Erca Loughn (341520)</td>
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<td>All</td>
<td>DMAIC Control</td>
<td>03/20/14</td>
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<td>OSU Medical Center</td>
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<td>Forecast Accuracy Improvement</td>
<td>329-68037</td>
<td>Trevor Simle (3275065)</td>
<td>Active</td>
<td>All</td>
<td>DMAIC Control</td>
<td>03/21/14</td>
<td>LATE</td>
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<td>AA Bushing and End Plug 55% L/T Reduction</td>
<td>329-68449</td>
<td>Nick Furgus (369976)</td>
<td>Active</td>
<td>All</td>
<td>DCOV Concept</td>
<td>03/09/14</td>
<td>LATE</td>
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<td>Diamond Innovations</td>
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<td>Waste Reduction Within Saw and Receiving for Saw Areas</td>
<td>329-68049</td>
<td>Erin Proctor (349076)</td>
<td>Active</td>
<td>N/A</td>
<td>DMAIC Measure</td>
<td>03/21/14</td>
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<td></td>
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<td>0</td>
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<td>Increasing Daily Percentage of Requests Completed by CC Unit</td>
<td>329-68735</td>
<td>Nathan Rohyana (363842)</td>
<td>Active</td>
<td>N/A</td>
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<td>03/12/14</td>
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<td>Orange</td>
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<td>0</td>
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<td>Internal Supply Chain Error Proof</td>
<td>329-78484</td>
<td>Josh Nevedrinski (334554)</td>
<td>Active</td>
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<td>DCOV Concept</td>
<td>03/09/14</td>
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<td>Central Sterile Supply Quality Assurance</td>
<td>329-68781</td>
<td>Vignesh Gundeshan (368318)</td>
<td>Active</td>
<td>N/A</td>
<td>DMAIC Improve</td>
<td>03/05/14</td>
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<td>OSU Medical Center</td>
<td>500,000</td>
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<td>Improving Alignment in the Client Referral Process</td>
<td>329-68616</td>
<td>Jessica Summer (32420)</td>
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<td>All</td>
<td>DMAIC Optimize</td>
<td>02/28/14</td>
<td>LATE</td>
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<td>Inventory Controls Process Design and Warehouse Optimization Project for Kitchen Corporation</td>
<td>329-68106</td>
<td>Jared Water (368639)</td>
<td>Active</td>
<td>All</td>
<td>DCOV Optimize</td>
<td>02/23/14</td>
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<td>Sulphon Corporation</td>
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<tr>
<td>Janitorial Closet Inventory Program Cost</td>
<td>329-78439</td>
<td>Chris Burton</td>
<td>Active</td>
<td>N/A</td>
<td>DMAIC Define</td>
<td>02/04/14</td>
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<td></td>
<td></td>
<td>OSU Purchasing, Receiving, Shipping and Mail</td>
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<td>0</td>
</tr>
</tbody>
</table>
Purpose, Objectives, Agenda

**Purpose:** Showcase a sampling of the great Integrated LeanSigma Capstone Certification projects from this past year in ISE at Ohio State.

**Objectives:**
- Quick get to know us and the program in ISE at OSU
- iSixSigma Final Tollgate Style Presentation on four Projects
  - Ohio Health
  - OSU PRSM
  - OSU Med Center
  - Mettler Toledo
- Spark dialogue

**Key Points:**
1. what’s the business and system/process and problem
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5. Insights, learnings, what’s next for me
IIE Annual Conference
Script Lead Time & Defect Reduction Project

Andrew Wharton
ILSS Green Belt Certified with Black Belt Certificate
The Ohio State University
About Me - Andrew

- Recent IE Graduate of The Ohio State University
- 3 Year Member of IIE
  - Past-President of Ohio State Chapter (#855)
  - Conferences: Reno, Orlando, San Juan, Montreal
- From Tipp City, OH (Dayton Area)
  - Oldest of 3 brothers
- Starting Work for General Mills in August
Scripts Were Prioritized as a Pain Point for Outpatient Imaging in Define

Pareto of Avg Waste RPNs (FMEA)

Scripts = Physician Prescription That is Sent to Ohio Health so Imaging Procedure Can Be Performed
2 Primary Problems
1. We Receive Scripts We Cannot Use
2. All Scripts Take Too Long to Process

Script Defects
• Patient Safety Risk
• Delay in Patient Care (~30 min)
• 2 FTE to Process Invalid Scripts

Lead Time to Dialer
• Physician Volume (Revenue) Risk
• Patient Satisfaction Pain Point

~280 Invalid Scripts per Month

External
Physician Writes Script
Validate Script
Yes: Schedule Patient Appointment
No: Contact Referring Physician

Upstream - Centralized
~3 Day Lead Time
Target: 1 Day
Lead Time Was Attributed to Lots of Duplicate Process Wastes and Imbalanced Cycle Times in a Push System

Main Entity

Station

Station 1

Station 2

Station 3

Station 4

Station 5

Central Support

Central Scheduling

Sub Tasks

Check Script Validity

Check Script Validity

Check Script Validity

Check Script Validity

Check Script Validity

Name & Sort Scripts

Name & Sort Scripts

Input Into Database

Attach to Schedule

Activate Dialer

Attach to Schedule

Check Script Flow In Process
Lead Time Was Attributed to Lots of Duplicate Process Wastes and Imbalanced Cycle Times in a Push System.

<table>
<thead>
<tr>
<th>Station</th>
<th>Central Support</th>
<th>Central Scheduling</th>
</tr>
</thead>
<tbody>
<tr>
<td># FTEs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>96 sec</td>
<td>57 sec</td>
</tr>
<tr>
<td>2</td>
<td>8 sec</td>
<td>60 sec</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>186 sec</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sub Tasks:
- Name & Sort Scripts
- Check Script Validity

Attach to Schedule
Input Into Database
Activate Dialer

Takt = 108 sec

Script Flow In Process
Eliminated Duplication & Increased Digital Measurements Using a Database Upstream in the Process

Takt Time Analysis for Script Management System

<table>
<thead>
<tr>
<th>Process Station</th>
<th>Current State</th>
<th>Resulting Future State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Support QA Station</td>
<td>8.65</td>
<td>8.65</td>
</tr>
<tr>
<td>Right Fax Station</td>
<td>57.5</td>
<td>60</td>
</tr>
<tr>
<td>In Progress Station</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>On Hold Station</td>
<td>186</td>
<td>93</td>
</tr>
</tbody>
</table>

Takt Time = 108

Database
System Has Gone from 3 Days to 1 Day for Script Processing

1. Confirmed Statistical Process Shift
2. Process Is In Control
Digital Data Captured On Front End Enables Real Time Reporting On the Back End (Sustainable Measurement System)

- Data Generates Dashboard
- Physician Script Report - Invalid Scripts
  - February 2014
  - Top Invalid Script Generating Physicians
  - Number of Invalid Scripts received for current month: 167
  - Reasons for Invalid Scripting

- Physician Relations Team Created To Proactively Educate Physicians & Drive Data Transparency

*No Shift At the Close of This Project
Physician Team to Start in April
Thank You! – Questions?

Andrew Wharton
Cell: 937-546-6937
Email: wharton.86@osu.edu
8 Wastes in Healthcare

WASTE is Anything That Does Not Add Value to the Customer

1. Over-Production or Over Staffing
   • Duplicate Charting
   • Excessive Diagnostic Testing

2. Idle / Wait Time
   • Waiting on test results
   • Waiting for surgeries, procedures, reports

3. Transportation
   • Transporting patients
   • Placing gurney in hall and constantly moving it

4. Over Processing or Inspection
   • Entering repetitive information
   • Ordering more tests than necessary
   • Requesting information that won’t be processed

5. Inventory
   • Medications and supplies in excess
   • Patients in waiting rooms
   • Insufficient cross training

6. Motion
   • Searching for people, chart, orders
   • Hand carrying paperwork
   • Search for poorly located supplies

7. Defects
   • Retesting
   • Medication errors
   • Wrong patient information
   • Missing information

8. Talent / Good Ideas
   • Failure to listen to employee ideas for improvement
Swim Lane Process Flows Helped Enable a Waste ID Session to Get to Initial FMEA
5 Why Analysis for Invalid Scripts

Information Transparency Root Cause

- Physicians Write Invalid Scripts
  - Not the Physician Writing the Script
    - Personnel Not Trained in Script Writing
  - No Feedback
    - Data Cumbersome
    - Data Not Collected
  - Doesn’t Care
  - Too Busy
    - No Feedback Showing Additional Time Their Practice Spends to Work Issues
  - Not Using Ohio Health Script Pad
    - Ohio Health
    - Private Practice or Out of Network
Business Functional Requirements Document Will Sustain IT System Gains Through EPIC Uncertainty

BFRD Summary

- Technical Document
- Maps Out Where Data Is Located And How Information Is Exchanged Amongst the Script Management System
- EPIC Can Replace Any of the Boxes as Long As It Assumes The Functionalities Of Those Boxes & Can Connect to The Other Systems
# FMEA & Applicable Reaction Plan for Each Solution Element

<table>
<thead>
<tr>
<th>Risk</th>
<th>Severity</th>
<th>Occurrence</th>
<th>Detection</th>
<th>RPN Score</th>
<th>Reaction Plan</th>
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</thead>
<tbody>
<tr>
<td>IT System Malfunctions</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>40</td>
<td>1. Call Matt Livingston or Current IT Owner</td>
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<tr>
<td>High Employee Turnover</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>36</td>
<td>Short Term: Utilize Training Document to Expedite On-Boarding of New Employees</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Long Term: Cross Training Employees</td>
</tr>
<tr>
<td>Loss Of IT Support</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>16</td>
<td>1. Ensure Ownership of Tool Is Written as Part of Job Responsibilities</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Look for Temporary IT Support</td>
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<td></td>
<td></td>
<td>3. Schedule Meeting with New Employee to Promote Tool Awareness</td>
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<td>4. Hire Third Party IT Support</td>
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<td>5. Probe Integration Into EPIC or Other Software Substitutes</td>
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<tr>
<td>System Unable to Cope with Demand</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>14</td>
<td>1. Pull a Weekly Summary Report</td>
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<td>2. Identify Date That Surge Occurred</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Identify Top Referring Physicians</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Work to Educate Physician Offices Using Time Spent As Incentive</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5. Review Employee Productivity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6. If No Clear Pattern Presents Look for Assignable Cause (New Facility Opened)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7. If # of Invalid Scripts Increases by a Sustained 20% consider additional resource allocations</td>
</tr>
</tbody>
</table>
The Project Laid a Foundation That Will Get Enable Original Business Goals

**WE Will Reach Our Business Goals**

**WE Must Continue to Execute & Sustain Our Goals**

Balanced Our Process Steps – Shifted Towards SYSTEM vs Individual Productivity

Removed Duplication **Wastes** From Our Systems

Fundamentally Fixed Our Measurement Systems

Internal Culture Change = ABCD
New Forms Help Increase Transactional Efficiencies for Physicians & Validators

FAX

To: Ordering Physician
From: Eastside Imaging Center
Re: Invalid Script — Action Requested
Disposition: Urgent

You are receiving this notice because:

☐ We Have Not Received a Script for The Following Patient for Services to Be Rendered Tomorrow
Requested Action: Please Fill Out This Form in its Entirety and Fax to 614-553-1111
(This Form Will Sufﬁce as a New Prescription for Your Patient)

☐ We Are Missing Vital Information from the Script That You Previously Faxed for The Following Patient
Requested Action: Please Fill Out the Circled Section, Signature, Date, and Time and Fax to 614-553-1111
(This Form Will Sufﬁce as a New Prescription for Your Patient)

Patient Name: ____________________ Date of Birth: ____________

Today’s Date: ________________ Time: __________________

Procedure:

Diagnosis:

Office Contact:

Ordering Physician:

(Most Fill All Fields Below This Line)

Physician Signature: ____________________

Date: ____________________ Time: ____________________

OhioHealth

Imaging Services Script

Required & Requested Elements for Legal Script

Today’s Date: ____________________

Patient Name: ____________________

Patient DOB: ____________ (MM/DD/YY) Sex: ☐ M ☐ F

Procedure Requested (1):

Ex: MRI Right Tib Fib
Right ☐ Left ☐ Contrast ☐ w/o ☐ w/wo ☐ w

Diagnosis: ____________________

Physician Signature: ____________________

Physician Printed Name: ____________________

Physician Instructions

□ Please Call Patient for Schedule.
□ Patient Not Scheduled. Patient to Walk-in.
□ Pre-cert Before Scheduling — For Assistance Please Call (614) 584.0113

Physician Office Information

Tax ID Number: ____________________

Office Contact Person: ____________________

Phone: ____________________

Fax: ____________________

Two Options to Schedule Imaging Procedures:
1. Call Central Scheduling at (614) 566.1111 or (614) 566.1112 and fax prescription to (614) 553.1111. OR
2. Fax this form to Central Scheduling at (614) 553.1111 and a scheduler will call the patient to schedule an appointment.

Note: Once the patient’s procedure has been scheduled, the referring physician’s office will be notified of the appointment times and location.
Database Entry

Add Fax

- **Script Date Received:** 4/7/2014
- **Procedure:** BoneDensity

Physician Office
- **Livingston, Matt**
- **Patient Last Name:** LIVINGSTON
- **Patient First Name:** MATT
- **Patient DOB:** 05/11/1971
- **Has Appointment Date:** Yes (4/7/2014)
- **Facility:** Delaware Health Center

Comments
- **DDD**
- **Prevent Prior to Scheduling:** Yes
- **Schedule from PWS:** Yes
- **Priority Physician:** Yes
- **Is Valid Script:** No

Invalid Script Data
- **Fax Document:** maness, nancy-pvl-02-03-jane.TIF
- **Problem:** Missing diagnosis

Physician Notification
- **Fax Number:** 614-596-6409
- **TO:** Matt Livingston
- **Notice:** The following patient MATT LIVINGSTON 5/11/1971 has a BoneDensity scheduled on 4/9/2014 12:00:00 AM at Delaware Health Center.
- **Notice Text:** The order is missing the following information: Physician signature.
- **Add additional comments here:**

Fax Notice
- **In an effort to be compliant with CMS regulations,** it is necessary to obtain a revised order. Please re-fax the updated order to (614)533-1111. If you have any questions, please don't hesitate to contact us at (614)533-5653.
- **Information:** This information is intended only for the use of the individual or entity named above. This information may be privileged or confidential; if you are not the intended recipient, be aware that any disclosure, copying, distribution or use of the contents is strictly prohibited by law.
- **Transmission Error:** If you received this transmission in error, please call the sender at the above number to arrange for destruction or return the transmission at our expense.

Back
Spearheading the Central Receiving project are PRSM Senior Director Nathan Andridge and Logistics Project Manager Shawn Jones. These two have taken the concept of a central delivery location and put it into practice in the past several months. By listening to users, designing better business processes, collaborating with several internal customers (FOD, Student Life, CampusParc) and changing employee culture, PRSM is now able to handle **2.5 times the package delivery volume** they could handle at the beginning of 2013.
Distribution and Logistics

The Ohio State University

• Founded Power Projections (projection advertising business)
• Grew up in Skillman, New Jersey
• BSISE and ILSS Green Belt Certified with Black Belt Certificate

Bed Bath & Beyond (Intern)

• Built slotting database for new Bed Bath & Beyond FC, used to slot about 100,000 SKUs
• Operational improvements within FC

Wal-Mart Logistics (Full-Time)

• Currently located in Mount Crawford, VA supporting R&D initiative
• Managing capacity project in Seymour, IN
PRSM needed a larger Capacity

**PRSM**
- Functions as a Central Receiving Facility for The Ohio State University
- Currently receives 20% of packages that reach campus

**Business Need**
- PRSM will take on larger volume
- Consolidation benefits include safety, cost and reduction of truck congestion on campus

**Opportunity**
- PRSM’s induction process cannot withstand a large increase in volume

**Mission**
- Increase throughput capacity at the induction step in the order fulfillment process
Receiving was the Chokepoint

The current bottleneck resides in the receiving process

Capability

- Not Capable
- Significantly Not Capable
- Current Bottleneck
- Inapplicable

Measure
Current State Performance did not meet Demand

<table>
<thead>
<tr>
<th>Process</th>
<th>Average</th>
<th>Std.</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unload</td>
<td>8 sec</td>
<td>3 sec</td>
<td>Package</td>
</tr>
<tr>
<td>Sort</td>
<td>5 sec</td>
<td>3 sec</td>
<td>Package</td>
</tr>
<tr>
<td>Transport</td>
<td>7 sec</td>
<td>2 sec</td>
<td>Order</td>
</tr>
<tr>
<td>Receive</td>
<td>152 sec</td>
<td>51 sec</td>
<td>Order</td>
</tr>
<tr>
<td>Sort</td>
<td>5 sec</td>
<td>2 sec</td>
<td>Package</td>
</tr>
<tr>
<td>Transport</td>
<td>117 sec</td>
<td>23 sec</td>
<td>Cart</td>
</tr>
<tr>
<td>Stage</td>
<td>5 sec</td>
<td>1 sec</td>
<td>Package</td>
</tr>
</tbody>
</table>

**Total Time to Receive (sec) =** 111

- 31.1 P.O. Included (Yes =1, No = 0)
- 75.6 Package Audited (Yes =1, No = 0)
- 16.1 Vendor Integration Score (Best =1, Worst = 3)

**Cycle Time:**
- Average of 152 sec, std. of 51 sec

Assuming 4 Hours of Receiving Time with 5 Receivers there are 1200 Available Working Minutes

At 2.5 minutes per order our Peak is 480 Orders or the equivalent of 720 packages
Cycle Time was Reduced, Receiver’s Daily Activities Improved

Receiver’s Previous Schedule

Fisher/OM arrives, packages are received, staged, 2 Receivers Arrive
FedEx arrives, packages are unloaded received, staged
UPS arrives, packages are unloaded received, staged
Receivers retrieve packages, take pallets down to staging
2 Receivers Leave
PRSM closes
3 MHs Arrive, 2/3 Additional Receivers Arrive

6 am 7 am 8 am 9 am 10 am 11 am 12 pm 1 pm 3 pm 7 pm

Receiver’s Current Schedule

Fisher/OM arrives, packages are received, staged, 2 Receivers Arrive
FedEx arrives, packages are unloaded received, staged
UPS arrives, packages are unloaded received, staged
Team’s Usual Completion Time, Leaves Time for 5S
Last Receiver Leaves
PRSM closes

6 am 7 am 8 am 9 am 10 am 12 pm 1 pm 3 pm 7 pm
Thank you for your time

Adam Claybrook
Logistics Engineer
adam.claybrook@walmart.com
Mount Crawford, VA

Define
Measure
Analyze
Improve
Control
Our Target Capacity of 2,000 can be Achieved

Future Demand
- Derives from UPS/FedEx, Vendors
- Large Bulk Drops will hit our Dock

Current Receiving Demand each Day by Month

Future Receiving Demand each Day by Month

291% Increase

Current Resources
- 7 Employees
- 5,000 sqft
- 5 Workstations

Future Resources
- 17 Employees
- 14,500 sqft
- 12 Workstations

Current Receiving Demand

Future Receiving Demand

Upper Limit

Average

Lower Limit

Measure

Over $300,000 Annually
Large Scale Change Occurred

Current State

- **Current Throughput:** 558 packages, std. 77
  Range of (315, 754)
- **Order Fulfillment:** Process is Mapped
  - Value Stream Map with applicable Metrics
  - Value Stream Analysis to determine Chokepoint
  - Areas of greatest opportunity have been identified

Current State Process Capability is defined

- Throughput capability is understood
- Identify points the Process will Fail after the new volume
- Confirm the current MS and MP capture the data we need and/or will need

Getting from 550 to 2,000

- Causes of Current Capability
- Choose critical inputs to improve that will give greatest ROI
- Identify values of inputs that optimize throughput

Solutions have been Tested and Implemented

- Pilot studies confirm higher volume capability
- Implementation Plans have been completed and distributed
- Confirmed Improvement in Primary Y

Proving significant change in throughput

- Data shows system is reliable with new volume
- Confirm the receiving process is capable through peak demand
- Ensure sustainable process

Future State

- **Increased Throughput:** 2,000 packages a day
- 2,000 package throughput
- Documented Procedures and Processes
- High Communication/Visibility
- Initiate Ownership/Accountability

Timeline:

- **February 2013:** Current Throughput
- **May 2013:** Solutions have been Tested and Implemented
- **December 2013:** Proving significant change in throughput
We Confirmed 4 Significant Opportunities in the Induction Process

8 sec Package → 5 sec Package → 7 sec Order → 152 sec Order → 117 sec Package → 5 sec Cart → 5 sec Package

**Two Critical Inputs were found in Receiving**

Every Audit Carried Out Adds **63 seconds** for Receivers

Non-Integrated Vendors add up to **44 seconds** for each Order

**One Significant Opportunity was found in Transport**

Accounts for **73%** of Variability in Cycle time

Utilizing better MHE can reduce the quantity of transport by **60% (30 trips)**

At **30 trips** per day we can save an hour of work by using MHE Carts

Unloading by Pallet versus Package

Data was collected by Adam from (2/1/2013 – 2/14/2013)
Process can Perform to Specs in the Future State

Solution Element

- Sampling Plan (Reducing Audit Quantity)
- Vendor Integration (Improving P.O.s)
- MHE/Flow

Potential Reduction in Cycle Time

- 48 seconds
- 35 seconds
- 6 seconds

Cycle Time Reduction After Solution Implementation

Receiving Capacity After Solution Implementation
Productivity has Risen Almost 300% Since February

**Productivity (2.2013 – 12.2013)**

- **Previous**:
  - Feb: 0
  - Mar: 0
  - Apr: 0
  - May: 0
  - June: 10
  - July: 20
  - Aug: 30
  - Sep: 40
  - Oct: 50
  - Nov: 60
  - Dec: 70

- **Change**:
  - Forecasted: 43 packages/hour

- **Forecasted**

- **With 5 Receivers**
  - Our New Capacity is: 1720 Packages
Solution Elements were Tracked for Quality - Majority were very Successful

Key Performance Metrics Tracked

These metrics were used to determine if it was beneficial to keep a solution element or return to the previous state.

<table>
<thead>
<tr>
<th>Metric</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact on Overall Operation</td>
<td>5</td>
</tr>
<tr>
<td>Simulation Effectiveness</td>
<td>4</td>
</tr>
<tr>
<td>Feedback / Engagement</td>
<td>3</td>
</tr>
<tr>
<td>Production in Real Time</td>
<td>2</td>
</tr>
<tr>
<td>Ergonomics</td>
<td>4</td>
</tr>
<tr>
<td>Safety</td>
<td>5</td>
</tr>
<tr>
<td>Productivity</td>
<td>4</td>
</tr>
<tr>
<td>Operational Flexibility</td>
<td>5</td>
</tr>
<tr>
<td>Scalability</td>
<td>5</td>
</tr>
<tr>
<td>Acceptability</td>
<td>4</td>
</tr>
<tr>
<td>Cost Effective</td>
<td>5</td>
</tr>
<tr>
<td>Positive Payback</td>
<td>5</td>
</tr>
</tbody>
</table>

Net Avg: 4.3

Benefits from Solution Elements were Analyzed

Data was collected by Adam/Shawn from 5/1/2013 – 10/1/2013
Realized Benefits - Reduction in Audits, Vendor Integration, MHE/IB Process Caused Significant Reduction in Cycle Time

**Audit**
- Estimated: 63 seconds
- Realized: 52 seconds

- Mean of Audit: 120.25
- Range: (94, 141)
- Mean No Audit: 68.29
- Range: (33, 89)

**Vendor Integration**
- Estimated: 44 seconds
- Realized: 50 seconds

- Mean of Integrated: 66.0
- Range: (33, 87)
- Mean Non-Integrated: 116.78
- Range: (73, 169)

**MHE/IB Process**
- Estimated: 55 seconds
- Realized: 48 seconds

- Mean Cart Method: 112.57
- Range: (94, 121)
- Mean Conveyor Method: 64.75
- Range: (33, 87)

**Takeaways**
- Benefits from Audit resort from the elimination of opening **ALL** boxes and the inspection of these boxes
- Critical Inputs for Vendor Integration that have been confirmed statistically include:
  - P.O. Location
  - P.O. / Tracking Number Shown
  - Numbers are Barcoded
- Conveyors and Altering Stock Handler SOPs had an impact on reducing cycle time of receiving

All data was collected by Adam from (10/18/2013 – 11/1/2013)
Improvements Decreased Cycle Time by 60 seconds

Cycle Time of Receiving (Previous 9 months)

2.1 min
1.1 min

Significant Difference Confirmed

- Difference of 58 seconds per Order
- The difference will usually be between 49.5 and 66.5 seconds

Additional Solution Elements

- Forecasting Demand
- Acquired MHE with Higher Capacity
- Integration with Carriers
$30,340 in total savings realized
Potential to save $387,000 in the future

Net Present Value at 6.82% IRR is $15,606.72

Realized Hard Benefits from Project

Investments
• MHE/Workspace Improvement - $5,000
• Computer Equipment - $500

Realized Hard Savings
• Employees in Receiving was reduced:
  • 7 to 6 in June
  • 6 to 5 in August
  • 5 to 4 in November

Soft Benefits
• Assume no change to previous state
• Will not count as realized savings but does show we prevented a significant future investment

To Truly Reap the Benefits we must Add Volume

Labor Savings versus Volume (Not Realized on Bottom Line)

Net Present Value at 6.82% IRR is $15,606.72

To Truly Reap the Benefits we must Add Volume
Process Improvement Project:
Decrease Turnaround Time for Portable Surface Echo

IIE National Conference
June 3, 2014
Presenter: Erica Loughry
Process Improvement Project:
Decrease Turnaround Time for Portable Surface Echo

IIE National Conference
June 3, 2014
Presenter: Erica Loughry
About Me

**Erica Loughry**  
- From Hudson, OH  
- Graduated from Ohio State with a B.S. in Industrial and Systems Engineering in May 2014  
- ILSS Green Belt Certified with Black Belt Certificate  
- 3 Year IIE Member  
  - Attended Annual Conference in Orlando and Montreal

Past Work Experience  
- 3 internships with GE  
  - Manufacturing and Process Improvement Work  
- 1 internship with JP Morgan Chase

Joining GE Healthcare Full-Time in July  
- Operations Management Leadership Program in Milwaukee, WI
My Project: Echocardiograms at OSU Wexner Medical Center

An echo is an ultrasound of the heart.

<!image: http://www.nhlbi.nih.gov/health/topics/topics/echo/printall-index.html>

Sometimes, a contrast is needed.

Portable Echo Locations

Echocardiogram Images:
Left=Without Contrast
Right= With Contrast (Definity)
http://content.onlinejacc.org/data/Journals/JAC/23023/05068_gr1.jpeg
Goal to reduce portable echo turnaround time to 24 hours

1. **Doctor orders surface echo for patient**
2. **Scan is scheduled through Non-Invasive Lab at Ross Heart Hospital**
3. **Inpatient receives scan in their room (portable scan)**
4. **Results are read by physician in lab**

- **Sonographer travels with machine to patient’s room**
- **Sonographer preps room and patient**
- **Sonographer conducts scan**
- **If contrast needed, nurse will travel from lab to room and administer**
- **Sonographer enters manual data and measurements**
- **Sonographer travels to next scan or returns to lab**
Current 75th Percentile Turnaround Time is 7.7 hours above 24 hour target

Why are we not reaching our turnaround time target?

- No nurse available to administer Definity
- Patient not available when arrive to room
- Echos ordered over weekend wait until weekday to be done
- 38% of scans are over the 24 hour target
- Current 75th percentile= 31.7 hours

Echos ordered Fri PM to Sun PM are either done Sat AM or the following week

Data Source:
TAT: IHIS-Time Stamps and Order Priority & Heartlab-Scan Location (7/1/12-10/31/13)
Process Step Data: Manual Data Collection (>200 points per step), (10/17/13-11/18/13)
Implemented Improvements to Reduce Scan Process Delays

**Problem**
- Portable Echos with a turnaround time of 24 hours or more

**Root Cause**
- Patient Not Available for Echo
  - Communication plan between nurses and sonographers
- No nurse available for Definity /Bubbles
  - Charge Nurse Standard Procedure
- Ambiguity around which echos get done first
  - Color-coding echo folders by patient location
- Interruptions during echo scans
  - Sign for the sonographers to place on the door during echo
- Lack of communication & visibility around the process
  - Daily huddle meetings to discuss common issues and metrics

**Improvements**
- Train Float Pool Nurses on Definity /Bubbles

**Patient Availability Script**
- Hello Mary, my name is Jane Doe. I would like to do an echo on your patient, Mr. John Smith, in room 2020
- Is he available and in the room?
- Is he currently in the chair?
- Is he close to needing his pain meds?
- Can you make sure he uses the bathroom?
- I will be in his room in approx. 10 mins.
Capacity Not Equal to Demand by Day of Week

A simulation was created and different schedule scenarios were analyzed to determine their impact on turnaround time.

Analysis was conducted to determine ideal staffing levels to meet demand.

Once the schedule has been implemented, we will be able to re-evaluate and see if we have reached our turnaround time targets.

### Simulation Output

<table>
<thead>
<tr>
<th>Hours of Operation:</th>
<th>Current Schedule</th>
<th>#1 Add Sun Hours</th>
<th>#2 Full Weekend Shifts</th>
<th>#3 Sun Hours w/4 FTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-F</td>
<td>7AM-5PM</td>
<td>7AM-5PM</td>
<td>7AM-5PM</td>
<td>7AM-5PM</td>
</tr>
<tr>
<td>Sat</td>
<td>8AM-1PM</td>
<td>8AM-1PM</td>
<td>8AM-5PM</td>
<td>8AM-1PM</td>
</tr>
<tr>
<td>Sun</td>
<td>N/A</td>
<td>8AM-1PM</td>
<td>8AM-5PM</td>
<td>8AM-1PM</td>
</tr>
<tr>
<td># Sonog. on Wknd Shift:</td>
<td>1.5 (Sat) 0 (Sun)</td>
<td>1.5 (Sat) 2 (Sun)</td>
<td>1.5 (Sat) 2 (Sun)</td>
<td>3.5 (Sat) 4 (Sun)</td>
</tr>
<tr>
<td>Estimated Turnaround Time of Scenario:</td>
<td>Overall: 31.0 hrs</td>
<td>Overall: 28.9 hrs</td>
<td>Overall: 26.9 hrs</td>
<td>Overall: 23.2 hrs</td>
</tr>
</tbody>
</table>
New schedule will help to reach initial definition of “Done”

**Initial State:** Aug 2013
- 75th Percentile of Turnaround Time for a normal priority portable surface echo is 31.7 hrs (FY13)
- Weekday=26.6 hrs
- Weekend=57.2 hrs
- 6.8 portable echos not completed every day (avg. FY13 data)
- Staffing model unable to accommodate variation in schedule (scans rollover)
- Significant Non-Value Added time in process
- Verbal complaints from physicians regarding increased turnaround time

**Current State:** April 2014
- 75th Percentile of Turnaround Time for a routine portable surface echo is 29.1 hrs (Mar ‘14)
- Weekday=23.1 hrs
- Weekend=50.5 hrs
- 4.3 portable echos not completed every day (avg. Mar ‘14)
- Staffing model unable to accommodate for variation in demand
- Collecting data on Non-Value Added time in process
- Verbal calls from physicians regarding increased turnaround time

**Future State:** July 2014
- Estimated 75th Percentile of Turnaround Time for a routine portable surface echo is 24 hours or less
- Weekday=24.0 hrs
- Weekend=24.0 hrs
- Decrease # portables not completed every day (non-patient explainable)
- Staffing model to accommodate variation in demand
- Reduction in Non-Value Added time in process
- Fewer verbal complaints from physicians regarding increased turnaround time
Any questions?

Objectives:
• Introduce myself
• Project Overview
• Answer any questions

Agenda:
1. Introduction
2. About Echocardiograms
3. Problem Definition
4. Data Collection and Analysis
5. Process Improvements
6. Questions

Thank you for your time!
Backmatter (Optional to Include)
Processes have been put in place to increase communication and data sharing. **Daily Huddle**

Purpose: Increase communication with sonographers

Daily huddle includes any updates or news for the day, along with a quick look from yesterday’s metrics.

**Monthly Scorecard**

Purpose: Report turnaround time, volume, rollover and productivity data

**Weekly Email**

<table>
<thead>
<tr>
<th>Date</th>
<th>Day of Week</th>
<th>Echos to be Scheduled</th>
<th>Portables Leftover</th>
<th>Total</th>
<th>Outpatients Scheduled</th>
<th>Add-Ons</th>
<th>In Lab Rooms</th>
<th>Portable Techs</th>
<th>Goal Echos to be Completed</th>
<th>Total Echos Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/1/14</td>
<td>Mon</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>4/1/14</td>
<td>Tue</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>70</td>
</tr>
<tr>
<td>4/2/14</td>
<td>Wed</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>13</td>
<td>0</td>
<td>4 and 5</td>
<td>4 and 5</td>
<td>63</td>
<td>50</td>
</tr>
<tr>
<td>4/3/14</td>
<td>Thu</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>11</td>
<td>2</td>
<td>4 and 5</td>
<td>3 and 4</td>
<td>54</td>
<td>46</td>
</tr>
<tr>
<td>4/4/14</td>
<td>Fri</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>12</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>56</td>
<td>45</td>
</tr>
</tbody>
</table>

**Transport Rating**

- Rating: 3

**Definity Rating**

- Rating: 5

**Patient Availability Rating**

- Rating: 4

**Notes on Ratings**
## Portable Echo Project Strategy

### Initial State: Aug 2013
- **75th Percentile of Turnaround Time for a normal priority portable surface echo is 31.7 hours**
  - Weekday=26.6 hrs
  - Weekend=57.2 hrs
- 6.8 Inpatient portables not completed every day (avg. FY12 data)
- Staffing model unable to accommodate variation in schedule (scans rollover)
- Verbal complaints from physicians regarding increased turnaround time

### Define: Problem Definition
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Determine project goals and scope</td>
<td>• Cleanse &amp; Merge data to find current state turnaround time</td>
<td>• Brainstorm root causes</td>
<td>• Create solution elements</td>
<td>• Ensure sustainability of improvements</td>
</tr>
<tr>
<td>• Identify process inputs and outputs</td>
<td>• Collect data around echo scan (scan time and NVA time)</td>
<td>• Demand vs. capacity analysis (simulation)</td>
<td>• Pilot solutions</td>
<td>• Develop control plan and scorecard</td>
</tr>
<tr>
<td>• Define primary Y (Turnaround time)</td>
<td>• Current State Process Capability</td>
<td>• Identify constraining process</td>
<td>• Design schedule variations</td>
<td>• Project Transition Action Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Validate significant root causes</td>
<td>• Implement scan process improvements</td>
<td>• Share results</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Prioritize root causes (FMEA)</td>
<td>• Design plan for echo schedule changes</td>
<td></td>
</tr>
</tbody>
</table>

### Measure: Data Collection

### Analyze: Define root causes

### Improve: Develop solutions

### Control: Project completion

### Future State: April 2014
- **75th Percentile of Turnaround Time for a normal priority portable surface echo is 24 hours or less**
  - Weekday=24.0 hrs
  - Weekend=24.0 hrs
- Decrease # portables not completed every day (non-patient explainable)
- Staffing model to accommodate variation in demand
- Fewer verbal complaints from physicians regarding increased turnaround time

### Business Case:
- Improved patient, staff and referring physician satisfaction
- Increase capacity for outpatient echos

### Requirements for Success:
- Open and honest communication
- Project Management
- Attention to detail
- Relationship and Change Management

### DMAIC:
- Problem solving approach to improving processes to build customer value and business success
- Data Driven → Determine true root causes
Increased Turnaround Time is due to multiple factors

Doctor orders surface echo for patient

Scan day is scheduled through Non-Invasive Lab at Ross Heart Hospital

Inpatient receives scan in their room (portable scan)

Results are read by physician in lab

Significant root causes identified through statistical analysis

Higher volume on Mon and Tues from weekend

Sonographer call offs/staffing levels

Duplicate ordering

Inappropriate ordering

Sonographer travels with machine to patient’s room

Sonographer preps room and patient

Sonographer conducts scan

Echo interrupted by other teams or tests

If contrast needed, nurse will travel from lab to room and administer

Sonographer enters manual data and measurements

Sonographer travels to next scan or returns to lab

Time spent manually entering data

Wait on RN for Definity/ Bubbles due to varying demand and no standard lead time

Not enough portable echo machines

Pt. not available for echo
Prioritized the different failure modes to determine areas of focus

2 Areas of Focus (exploit the scanning process constraint):

- 1. Capacity ≠ Demand by Day of Week
- 2. Delays and NVA time during the scanning process
2 Main Areas of Focus: Scanning Process & Schedule

2. Delays and NVA time during the scanning process

![Chart showing time spent doing 5.3 echos per day using current average process times]

Failure Modes during Scanning Process:
- Pt. not available due to other testing
- Echo interrupted by other teams or tests
- Wait on RN for Definity/Bubbles
- Time spent manually entering data
Simulation is being used to determine idea schedule and staffing for Echo Lab

**Model Inputs:**
- Sonographers per hour
- Scan Time
- Orders placed by day of week and hour of day
- Productive Minutes per Hour of Sonographer

**Model Outputs:**
- Order to Echo Start time for all echos and by day of week and hour of day
- Orders Placed by day of week and hour of day
- Sonographer Utilization

<table>
<thead>
<tr>
<th>Metric</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portable Volume</td>
<td>✔️</td>
</tr>
<tr>
<td>Portable Scan Time</td>
<td>✔️</td>
</tr>
<tr>
<td>Sonographer Utilization</td>
<td>✔️</td>
</tr>
<tr>
<td>Turnaround Time</td>
<td>✔️</td>
</tr>
</tbody>
</table>

Currently adjusting the following to determine the ideal future state schedule:

- # of Sonographers per hour (move people and keep same FTEs)
- Scan Process Time (account for scan process improvements)
Decreasing Non-Value Added Time in Pick, Pack, and Ship

IIE National Conference
June 3, 2014
Eleanor Cooper
About Me

Eleanor Cooper
- Alumna of The Ohio State University
  - Graduated May 2014
  - B.S. Industrial and Systems Engineering, Minor in Business
  - ILSS Green Belt Certified, Black Belt Certificate
- Vice President: Alpha Pi Mu Gamma Chapter, the ISE Honorary
- 3 Year Member: OSU IIE
- 4 Year Member: OSU Marching Band

Past Work Experience

- **The Boeing Company** (Summer 2013)
- **General Electric Lighting** (Spring/Summer 2012)
- **Cooper Tire and Rubber** (Summer 2013)
- I have accepted a job with **The Boeing Company** starting in July.
  - Industrial Engineer for the 737 Program in Renton, Washington
What is MTMS and what was the problem?

- **Company Bio:** METTLER TOLEDO is a precision weighing company that produces laboratory, industrial, and retail products. At the Masstron Facility, we produce heavy capacity floor scales, vehicle scales, railroad scales, and weigh modules.

- **Project Description:** This project focuses on the pick, pack and shipping operations of vehicle and floor scales. This area is the final stop before products reach customers.

  
  Packer receives production order and assembles kit  
  Kit set aside or put on shelf  
  Pick list generated for packers, send necessary items to shipping

  Order confirmed and verified by shippers  
  Order staged for truck loaders

**Problem:** A lack of standard workflow and communication leads to non-value added time in the process.

**Study of One Type of Kit Revealed Large Variation and Range for Lead Time—Why is the Kit Sitting Idle?**

**Lead Time for a Kit: Sample of One Material Number**

- 52hr
- 114hr
- 178hr
- 228hr
- 270hr

- **NVA >90%**

- Varied lead times
- Based on the system that releases/plans orders), no kits should be in the system more than 48 hours.

**Project Focus:** Design a future state pull system to decrease the disparity
Changes were detailed for target areas that were prohibiting pull and transition projects were identified.

**Initial Target Areas Identified**
- Current and ideal states were described for each area.

**Swim Lane Diagrams**
- Showed needed changes to process.
- Effect of changes were shown on Lean Scorecard, tracked major sources of NVA time.

**Annotated Process Maps Were Created to Detail Changes to the Processes**
- Key long term projects (orange)
- Lean elements to facilitate pull (green)
- Tools created to improve scheduling/capacity planning (blue)
Planning and aligning the migration to 2015

April 2014—Work was transferred

► New project owners were given all associated documentation
► Roles/responsibilities of team members were made clear
► Buy-in of migration through March 2015

March 2015—Transition complete

- Influence production to be done on day it is due
- Both tools show visual capacity

Ideal Lead Time:
Kit is Made and Shipped in One Shift

NVA ~ 20%

Value Will be Fully Realized in March 2015

► New standards followed for order release and scheduling
► Kit idle time and lead time will decrease, improved VAR
► Daily use of tools created

The transition plan to migrate from <20% VAR to over 90%. 
### APRIL 2014

- Determine where load leveling occurs presently
- Determine problems and failure modes for current state load leveling
- Pull all production data
- Analyze top percent of demand
- Get time estimates from workers for top demanded material numbers
- Sum all demand and time by worker to compare
- Observe and describe miscommunications in FS that add rework
- Define the errors/miscommunications and develop a data sheet to collect info (4/22)
- Roll out data sheet (4/22)

### MARCH 2015

- Leaders for projects were established
- No days over capacity
- Workers are not given too much/too little work
- Clearly defined daily schedules for workers, outline of work to be done and when
- All ramps and frames added at assembly
- Standard kits incorporated into Kanban system
- All process times and new standard kits incorporated
- Necessary changes made for FS project

---

**Capacity Planning**

**Scheduling Optimization**

**Floor Scale Redesign**

**Pick/Pack Initiative**

**SAP Integration**

---

**Lead time (order release to shipping) from study of a Install KOP for Vehicle Scales:**

<table>
<thead>
<tr>
<th>Lead Time (hr)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td>100%</td>
</tr>
<tr>
<td>114</td>
<td></td>
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<tr>
<td>178</td>
<td></td>
</tr>
<tr>
<td>228</td>
<td></td>
</tr>
<tr>
<td>270</td>
<td></td>
</tr>
</tbody>
</table>

**Sample Kit Lead Time Sample**

- NVA = 20%
Questions?

Thank you for your time!
How will the process work at each step?

**Overall Process**

1. Orders are entered into system
2. Orders and pick lists released to production
3. Packer receives production order and assembles kit
4. Kit set aside or put on shelf
5. Pick list generated for shippers, gather remainder of order
6. Paperwork/confirmation and verified by shippers
7. Order staged for truck
8. Truck loading/Order loading
9. Truck leaves facility

**Sales**

- **Start**
  - Orders are entered in by sales function who gets the customer order

**SAP (IT)**

- Order becomes planned order in SAP
- Production order stay as planned order until SAP release date (usually day before Goods Issue Date—or day it leaves)
- Production orders generated
- Deliveries for day are displayed for that day (VL10G)

**Production Scheduler**

- Production order released on release date
- Released orders and pick lists are generated into a schedule at the beginning of the day/day before
- At beginning of day, print all available pick lists
- Scheduler prints schedule and associated paperwork
- Delivers schedule to appropriate worker

**Schedule Optimizer**

- Production orders have a general process time associated with them
- Pick lists have a time estimate depending on what items/how many items need to be picked
- Baseline schedule is created with prioritization for pick lists being done in the morning, then production

**Element to be Tracked** | **Impact Desired**
--- | ---
Scheduling release accuracy | Inc. 1 2 3
Computer and Paperwork in Kit Packing | Dec.
Average time of orders sitting without pick lists? | Dec. 2 3 4
Scheduling time | Dec. 2
Order Errors | Dec.

**Notes**

1. Orders are released ON release date
2. Released orders and pick lists are generated into schedule at the beginning of the day
3. Production orders and pick lists have estimated process times that allow schedule generation
4. Production orders will have an approximate due time
How will the process work at each step?

1. Pick lists that are ready are completed first
2. Production orders completed next
3. If production order generates a pick list (if for that day) generate to worker's computer
4. Production orders for next day delivery will be placed in designated area with date

### Element to be Tracked | Impact Desired
--- | ---
Scheduling release accuracy | Inc.
Computer and Paperwork in Kit Packing | Dec.
Average time of orders sitting without pick lists? | Dec.
Scheduling time | Dec.
Order Errors | Dec.
How will the process work at each step?

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- Orders entered into system
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- Pick list generated for shippers, gather remainder of order
- Paperwork/confirmation and verified by shippers
- Order staged for truck
- Truck loading/Order loading
- Truck leaves facility
- Pick lists given to packers, send necessary items to shipping
- Completed items put in designated area
- Ready for pick up by carrier
- Carrier arrives, loaded
- Orders leave facility

**FS Shipper**
1. Start
   - Completed items put in designated area
   - Complete paperwork
   - Place in designated area
   - Ready for pick up by carrier
   - Carrier arrives, loaded
   - Orders leave facility

**TS Shipper**
2. Start
   - Receive kits from worker
   - Receive pick list for TS delivery (designate a time beforehand)
   - Complete pick list (designate a time beforehand)
   - Place order in labeled area of workcell
   - Staged, complete order
   - Complete any necessary action items

**Truck Loaders**
- Element to be Tracked
  - Scheduling release accuracy: Inc.
  - Computer and Paperwork in Kit Packing: Dec. 3
  - Average time of orders sitting without pick lists?: Dec. 2
  - Scheduling time: Dec. 1
  - Order Errors: Dec. 2
  - Complete any necessary action items
  - Truck leaves facility

1. FS shipper will have orders to process immediately upon arrival
2. Pick list will be received a designated time before order leaves (t-8)
3. Order will be done and staged a designated time before (t-4)
4. Time buffer for complications
Floor Scale Process—where do the projects that are planned come in the process?

**Blue:** Tools being created  
**Orange:** Longer-term projects  
**Green:** Other lean elements  
*Note: shading shows progress*

**Gantt Chart** will lay out future projects to aid in the transition

**Process/Workflow Redesign** to enable completed scales to be sent to shipper and eliminate rework/idle time of unfinished goods

**Defect Prevention** by eliminating a step that allows miscommunication

**SAP Integration** will take place to make order release/BOM changes

**Lead time expectations**

**Inventory buildup is unavoidable** here due to the nature of the delivery schedule.

**Core pull by day** is attainable with tool in assembly—only producing what will ship that day, controls the lead time.

**Visual processes** can be bettered with more devoted use to hour by hour board

**Changeover/Setup Reduction** by doing scales in predetermined optimal sequence

**Process/Workflow Redesign** to enable completed scales to be sent to shipper and eliminate rework/idle time of unfinished goods

**Defect Prevention** by eliminating a step that allows miscommunication

**SAP Integration** will take place to make order release/BOM changes

**Lead time expectations**

**Inventory buildup is unavoidable** here due to the nature of the delivery schedule.

**Capacity planning and demand analysis** could lead to realization that this employee can be a floater/better utilized

**Scheduling and order release improvements** will enable more visibility of work content and better utilization
Truck Scale Process—projects and elements to be addressed

**Packer** receives production order and assembles kit

- **Kit set aside or put on shelf**
  - **Send necessary items to shipping**
    - **Pick list generated for packers**
    - **Pick list generated for shippers, gather remainder of order**
      - **Order confirmed and verified by shippers**
        - **Order staged for truck loaders**
          - **Finished Goods**

**Semi Finished Goods**

**Visual processes** can be bettered kanbans and color coded standard kits and HxH boards

**Strategic buffer/kanban** will come into affect after pick/pack project to stock these standard kits.

**Pick/Pack Initiative (led by Aaron)** will lead to standard kits that can be stocked

**Scheduling and order release** improvements will enable more visibility of work content and better utilization

**SAP Integration** will take place to make order release/BOM changes

**Truck Scale Planning Tool** will dictate release until SAP/scheduling is fully adjusted

**Capacity planning and demand analysis** could lead to realization some tasks should be redistributed

**Gantt Chart** will lay out future projects to aid in the transition

**Lead time expectations**

**Core pull by order** will be attainable after completion of projects.

Blue: Tools being created
Orange: Longer-term projects
Green: Other lean elements
*Note: shading shows progress*
Thank you for attending! Your feedback is very important. Scanning this QR code will take you directly to the evaluation for this course.