Manufacturers Alliance Seminar

Continuous Improvement Idea Systems

Practical experiences from peers on engaging every individual in making improvements

PROTOLABS
Manufacturing. Accelerated.

Continuous Improvement Idea Systems At Protolabs

Presenters Dan Olson & Kevin Johnson

PRESENTERS: Dan Olson & Kevin Johnson

> RAPID PROTOTYPING AND ON-DEMAND MANUFACTURING IN AS FAST AS 1 DAY

+$380M
Pro forma revenue (2017)

+2,000
Employees

+37,000
Product developers served (2017)

12
Manufacturing facilities globally

+1,000
Mills, lathes, presses, 3D printers

3.1 million
Parts manufactured per month

INCREASE SPEED TO MARKET | REDUCE COSTS | OPTIMIZE SUPPLY CHAIN

SUITE OF SERVICES

- 3D Printing
- CNC Machining
- Sheet Metal Fabrication
- Injection Molding

Continuous Improvement

It's Part of our Culture

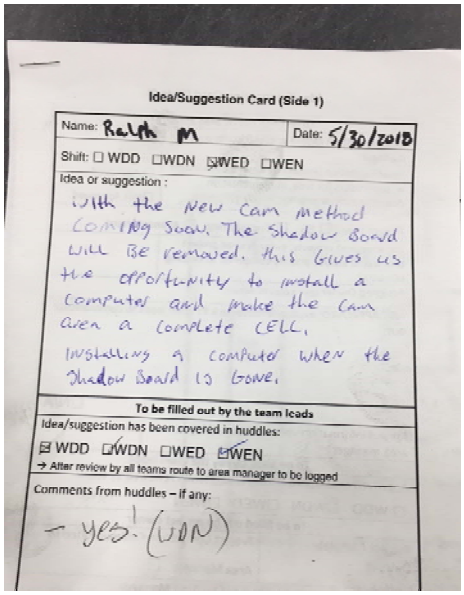
Change is the one constant at Protolabs

Idea Generation

- Starts with
- Daily huddles
- It's part of the agenda
- Each huddle goes through the basic KPI's
- SQDC (Safety, Quality, Delivery, Cost)
- New suggestions reviewed daily
- Status updated on open suggestions

Ideas / Suggestions

- Idea reviewed at huddles
- Managers/supervisors determine next steps
- Could be turned into a project
  - 5S, Engineering, Management, Just do it
- If not approved communication happens with individual and huddle group
- Form filled out, idea and decision communicated to area
- Project assigned



Idea/Suggestion Card (Side 1)

Name: Ralph M Date: 5/30/2018

Shift: ☐ WDD ☐WDN ☑WED ☐WEN

Idea or suggestion :

With the New Cam Method Coming Soon, The Shadow Board will be removed. This Gives us the opportunity to install a computer and make the Cam area a complete CELL. Installing a computer when the Shadow Board is Gone.

To be filled out by the team leads

Idea/suggestion has been covered in huddles:

☑ WDD ☐WDN ☐WED ☑WEN

→ After review by all teams route to area manager to be logged

Comments from huddles – if any:

- yes! (WDN)

Idea/Suggestion Card (Side 1)

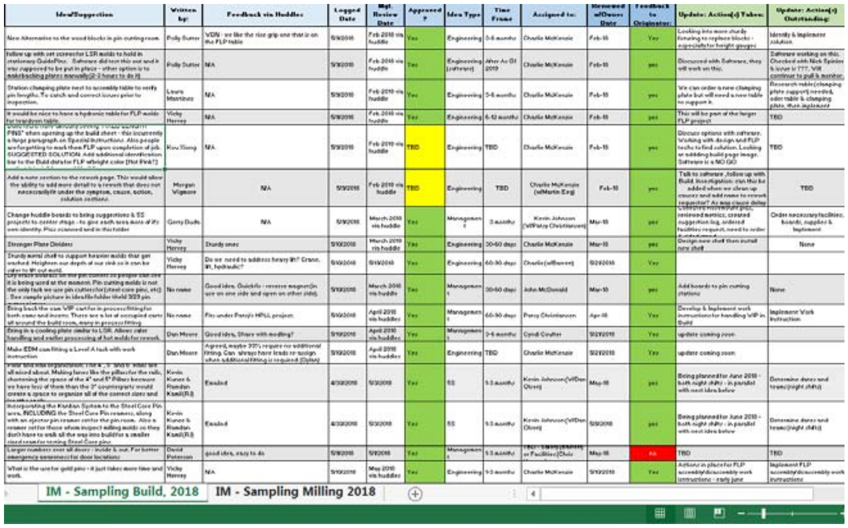
Name:	Date:
Shift: ☐ WDD ☐WDN ☐WED ☐WEN	
Idea or suggestion :	
To be filled out by the team leads	
Idea/suggestion has been covered in huddles: ☐ WDD ☐WDN ☐WED ☐WEN → After review by all teams route to area manager to be logged	
Comments from huddles – if any:	

Idea/Suggestion Card (Side 2)

To be filled out by area manager	
Idea/suggestion logged in IDEAS log by area manager	Date:
Idea/Suggestion (Project) reviewed by manager w/supervisors for type, implementation determination & priority:	☐ Approved ☐Not Approved
Project Type: ☐ 5S ☐ Engineering ☐ Management	
For approved projects, enter desired project timeframe and/or priority compared to existing projects?	
Assigned Owner (give a copy to owner):	
NOT APPROVED: explain & route back to team leads to communicate out: ☐N/A	
Project information updated in IDEAS log by area manager	Date:
To be filled out by the team leads	
Approved or Unapproved: idea/suggestion reviewed by team: ☐ WDD ☐WDN ☐WED ☐WEN	
To be filled out by project owner	
Project Complete Date:	Project Completion Communicated to Area Manager ☐
To be filled out by Area Manager	
Project Completion Logged in IDEAS log	Date: By:
To be filled out by the team leads	
Project Completed: Announce completion to team: ☐ WDD ☐WDN ☐WED ☐WEN → Discard after reviewed by all teams	

3D Printing / CNC Machining / Sheet Metal Fabrication / Injection Molding

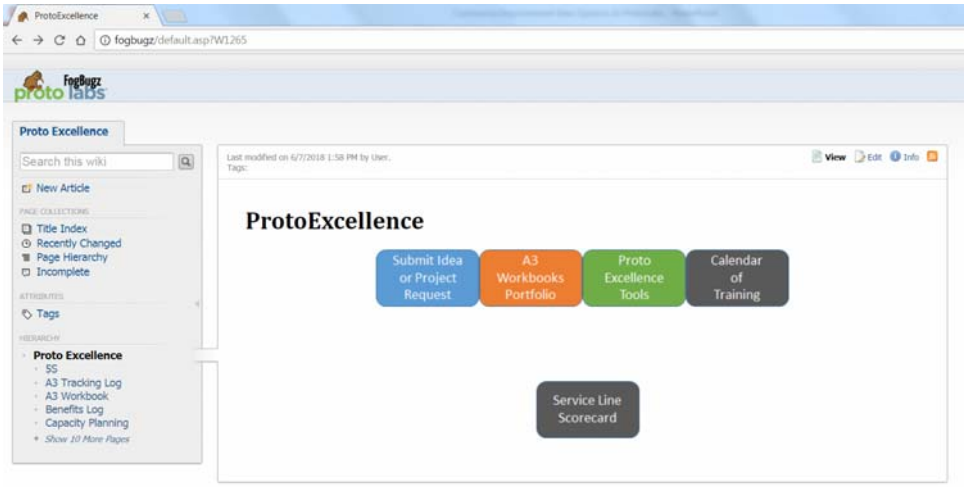
Suggestion Log tracks Ideas



Communication Is The Key

- Idea is communicated to all 4 shifts
- Feed back generated
- Decision made
- Action assigned
- Log updated /posted
- Project completed
- Project closed

Electronic Version



ProtoExcellence Administrative Structure

Intake	Project Management	Tools Deployment	Calendar
• Front end link, open to all employees. • Click to open simple form to submit new idea, or to document a 'just do it'. Standard cost/benefit criteria. • Submit and saves as 'hopper' project (or completed 'just do it').	• Projects ranked in 'hopper'. • Move projects from 'not started' to 'in progress' to 'completed'. • Task management. • Project Status. • Validated Cost/Benefits for rollup purposes.	• Library of tools, categorized in a list view with a brief description. • User can download and use.	• Calendar view of upcoming training and events.

Ideas Breed Ideas

- We shamelessly steel ideas from wherever we can
- Proto Excellence Boards in all locations
- Feature highlights from across the organization
- Highlights e-mailed out monthly across all regions

PROTO EXCELLENCE in MOTION

3DP Quote Process Raleigh – Turn Time Kaizen Event

Key Countermeasures
Computer Hardware Upgrades
Quick Reference Guide for Standard Quote Responses
Phone Queue Level Loading
Standard FAQ Template for Sales & Customer Service
Work Cell Roles by 3DP Technology
Quote demand smoothing by shifting order processing to Analyst role

Problem: Quote process was not meeting its turn-time requirement, resulting in substandard customer service.

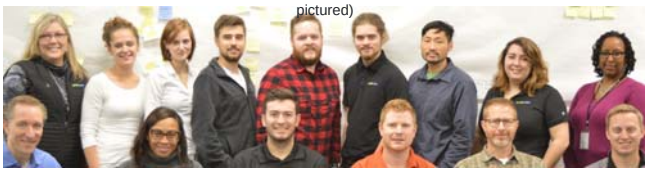
Tools: Value Stream Mapping, Data Analysis, Problem Solving

Principles: Process Focus, First Pass Quality, Systemic Thinking

Results: Process now consistently meets the 4 Hour Turn Time goal. Additionally, productivity is increasing and queue times are improving.

Metric	Prior to Event (most of 2017)	Current State (April data)	Goal
Quote Turn Time (median)	7.75 hours	2.55 hours	<4 hrs
# Quote Transactions / Quoter / day	6	16	18
Initial Queue Time (average)	~ 4-6 hrs	1-3 (estimated)	<2 hrs

Sandy D, Kate G, Jordan L, Matt M, Rob Y, Jesse C, Ben W, Elena T, Anita H, Nate H (not pictured)



Kevin A, Pamela W, Joe C, Josh P, Neal Z, Brandon M

Lost and Found Material Rosemount

Stop Light board to balance work & identify bottle necks

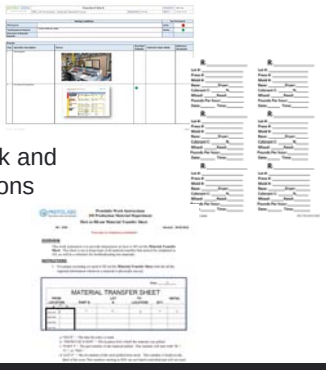
Problem: Material handlers are stretched thin and inventory accuracy is below 85%

Tools: Swim Lane Diagram, 5S, Visual Mgmt, Line Balancing, Problem Solving

Principle: Flow/Pull, First Pass Quality, Process Focus

Results: Mapped processes, created 6 standard works, updated work instructions, created stop light board to balance work. Created plan for future cycle time improvements*.

Metric	Old	New
Cycle Time	51 min	25 min
Expected Cycle time Future State	51 min	7 min (*estimated based on future improvements)



Standard work and work instructions

Everyone, Everyday, Everywhere Continuous Improvement

ProtoExcellence is most powerful when everyone in the company is solving all sizes of problems encountered everyday to continuously improve the processes we work in and bring value to our customers.

Location: Plymouth Build
Who: Dan Moore (OJT Trainer)
Problem: Measurement tools misplaced in Build Inspection area
Action: Created shadow box & labeled tools
Benefit: Tools always in the proper place and less likely to get lost or damaged

Location: Plymouth Build
Who: Bob Ahles (OJT Trainer)
Problem: Previous set up was old, worn, hard to read and cluttered
Action: Revitalize to improve set in order
Benefit: Mobile, controlled supply, visual & efficient

Location: Customer Quality Team
Who: Cody Merrell, Jared Smith
Problem: Capacity impacts to personnel and inconsistent data entries on repetitive NC tasks
Action: Standardized entries using auto hotkey scripts & gamer mouse (an idea adopted from Tech Ops)
Benefit: ROI of 10X. Data consistency. Plan to expand improvement to Customer Service.

Kaizen is about incremental improvement by everyone, everyday, to continuously move towards an ideal state.

Other Places We Share and Generate Ideas

- Kaizen events
- Targeted brainstorming
- Shift meetings
- Achievement walks
- A-3 Tracking Log

A3 Tracking Log

ProtoExcellence In Motion. Click on 'Workbook' to learn more about the project.

Status Key:

Hopper: Not Started

In Process: Work is Underway

Control: Kaizen Event Completed, or New Process 'Live', & Monitoring Improvements

Closed: Project Closed

Title	Date	Department	Location	Objective	KPI's
Inspection Area 55 Sheet Metal Proto	1/24/18	Sheet Metal Proto	New Hampshire	Improve flow, 55 area	Cycle time, Catches, Escapes, Steps,
CQE VSM	2/6/18	CQE	Plymouth	Map Process develop KPI's	E mails, phone calls, NC's

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Part Insert Management Kaizen

Team

Drew Stangler, Daren Braun, Perry Haddad, Nate Lawton, Phillip Whiting, Hannah Johnson, Tim Rick Bette Bems Murphy, Jason Anderson, Vilaiphon Xiong, Nick Anderson, Bob Bannick, Dan Olson

Insert Molding Details:

- Started to take orders mid 2016
- Steady order volume through 2017
- Future growth is expected as we create the ability for customers to order through the normal internet order process.
- Current process has variation in our on time delivery and our defect rates.
- Struggle with inventory management which results in delayed orders

Challenges

- Customer service had no confidence in inventory accuracy or visibility in AX
- E-mail chains included over 60 people
- No traceability to quantities
- Multiple employees and inserts traveling across plants multiple times
- Inserts and molds in different locations

Results

- Insert accuracy improved from 27% to 99.1%
- E-mail chains eliminated
- Can now see updated quantities in AX
- Streamlined inspection process to eliminate travel within buildings
- Established a process for inserts to follow molds

Testimonials

- "The system is working so well we are considering opening up this process to the entire customer service team in the near future." **Customer Service Dept.**
- "Before this event, I was receiving over 50 e-mails/week for insert counts and now I get less than 1/week." **Supply Chain Dept.**

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Where We Struggle and What We Are Doing About It

- Large number of ideas and suggestions
  - Good problem to have
- Lack of tracking or next steps
  - Tracking log
- Prioritizing lack
  - Coming up with a ranking system
- Bandwidth of facilitators
  - Training other people to lead / facilitate events
  - Kaizen on how we do Kaizens

Kaizen Event Name	DMLS Finishing Re-organization	Start date of Kaizen	6/4/2018 2:00PM	Kaizen Sponsor	Dan Olsen
Event Leader	Jay Katz, Andy Bartholomew	All Start Date (Date format: m/d/yyyy)	6/4/2018	30 Day Follow Up Date (Post Event)	auto-calc

Problem Statement / Current State

WHY IS THIS IMPORTANT/Background/Data for charter:
To accommodate the growth of DMLS and post production customer requirements.

Current state details:
- Non-optimal part flow/process flow
- Excessive walk times/distance
- 5s Opportunities

Scope

DMLS finishing and machining areas as well as part flow from heat treat to shipping.

Objective / Goals

- Optimize part flow from build completion to shipping
- Optimize layout and 5S Machining area

Project Validation

- New capital equipment (5 axis mill and 3+2 axis mill)
- Observed excessive walk time and inefficient part flow

EVENT METRICS

Metric	Goal	Current result (Using)	Achieved Red/Green
Walk time	25% reduction	57	Red
(Measurable KPI)	$...		Auto

TEAM / STAKEHOLDERS

Jay Katz	Leader
Andrew Bartholomew	Sponsor
Will Mecop	Team Member
Alex Solis	Team Member
Justin Sawyer	Team Member
	(Name - Title)
	(Name - Title)
	(Name - Title)
Kenny Capps	stakeholder
Greg Tompson	stakeholder
Jonathan Bissmeyer	stakeholder
Kevin Ashton	stakeholder

IMPLEMENTATION PLAN

Key Actions	Action Owner	Week #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		Date	6/4	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23	6/24	6/25
Pre-event Actions/Milestones																						
Pre Check List Started (Tab on workbook)	Jay Katz, Andy Bartholomew		X																			
Pre Check list Completed	Jay Katz, Andy Bartholomew							X														
Install new Mills	Facilities							X														
Data drops for computer moves	Contract		X																			
Install power drops for machining area	Facilities						X															
Order bin system components, if needed	Jay Katz				X																	
5S supplies (foam, peg board?)	Dan							X														
Notify facilities, IT about event if they are needed.	Andy				X																	
During Event Actions ("Just Do It" Completed in Event)																						
Move Shipping Department								X														
Relocate computers and scanners closer to furnaces/handlers	Team							X														
Complete layout in Machining area (tables, toolboxes, etc.)	team							X														
Organize tooling in machining area (location, labeling, etc.)	Will							X														
Tape Flow	Dan							X														
locations for PM supplies	Justin							X														
Tape spot for New Mill	Justin Dan							X														
Foam Cabinit	Will							X														
Eliminate red and black toll boxes	Dan							X														
Arrange for scrap metal barrels	Jay							X														
Move computer and table for heat treat	Jay							X														
Hang tool board	Matt							X														
Post-Event Actions (To be completed within 30 days of event)																						
Start Post Check List (Tab on workbook)	Jay Katz, Andy Bartholomew																					
Schedule 5S audit	Andy B																					
Schedule 30/60/90 day follow up	Andy B																					
Schedule red tag review	Andy B																					
Set up new tables	Justin																					
Hang boards for new tables	Justin																					
Boards for scrap metal in place	Jay																					
Finish foam drawers and label	Alex																					
Ball drill press to floor	Jay																					
Review / Organize tools for new tool box	Justin / Alex																					
Organize tooling for new mill	Justin / Alex																					
CHECK / EVALUATION / CONFIRMATION OF RESULTS																						

(Use this space to visually show metric tracking for Measurable KPI's)

Summary

- Actively solicit ideas
- Make it an expectation
- Implement ideas
- Provide feedback
- Encourage the crazy idea
- Brag about your accomplishments
- Encourage everyday improvements
- Show measurable results
  - Steps, time, dollars saved

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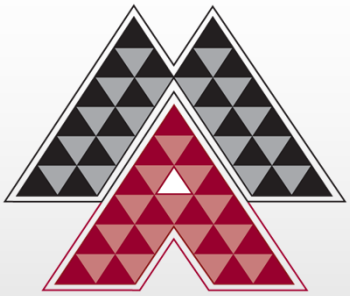

Manufacturers Alliance

Thank you for joining us!

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