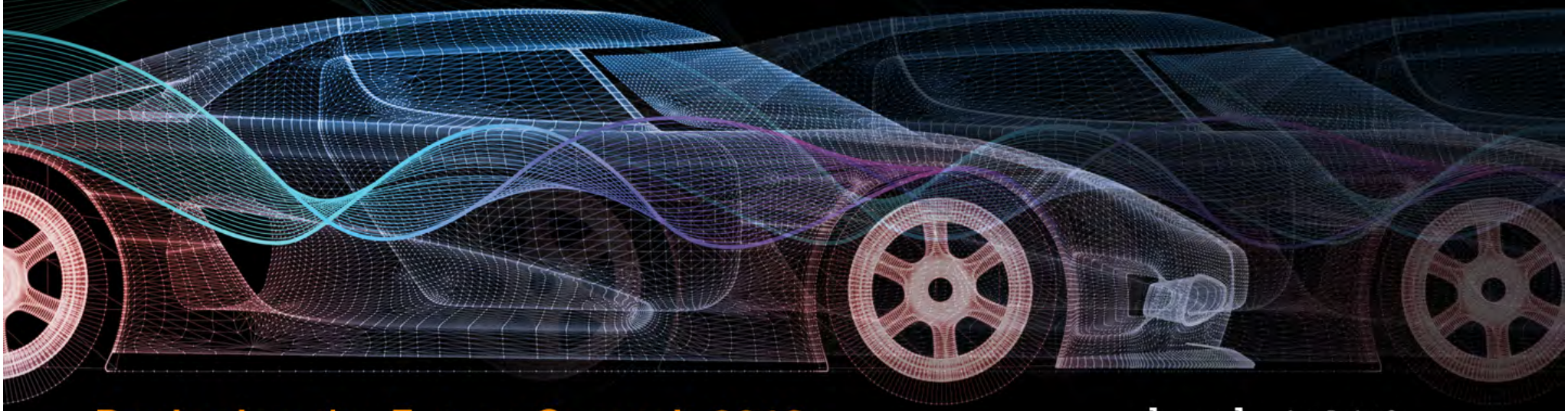
Using Experiments to Learn and Continuously Improve

Presented By Howard Kinkade



Designing the Future Summit 2018

lppd Lean Product & Process Development

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Solar® Turbines
A Caterpillar Company

- Solar's History
- Design / Development Challenge
- Rapid Expansion of Lean Experiments
- The '6th Why'
- Cultural Revelation & Organizational Evolution

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Caterpillar: Non-Confidential

SOLAR'S HISTORY

- 1927 - Prudden-San Diego Airplane Company
- 1929 - Solar Aircraft Company, Component Mfg.
- 1940s - Jet Engine Afterburners and Small Gas Turbines
- 1950s - Aerospace and Shipboard Power Generation
- 1960s - Centrifugal Compressors and Gas Turbines

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Caterpillar: Confidential Yellow

SOLAR'S HISTORY

- Today - World's Largest Manufacturer of Industrial Gas Turbines (1 to 22 MW)
- Over 15,000 Gas Turbines and Over 6,000 Gas Compressors Sold
- Serve Power Generation and O&G Markets
- Installations in over 100 Countries
- Global Workforce ~ 7,000 Employees
- 65 Sales & Service Locations
- Subsidiary of Caterpillar Inc. Since 1981

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Caterpillar: Confidential Yellow

SOLAR – Design / Development Challenge

- 2008 – Competition Introduces New Turbine, With Competitive Performance
- Marketing / Sales – We Need a Product Performance Uprate, NOW!
- Director of Turbine Product Development, “Where to Start”?

Continue Phase Gate NPI Process

Or

Experiment with Lean Product and Process Development

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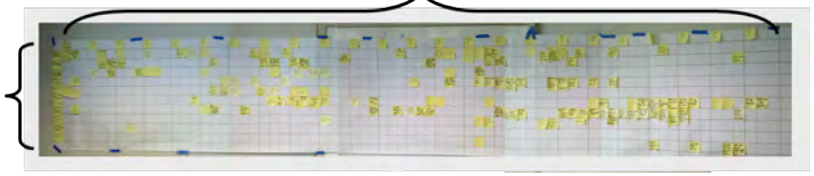
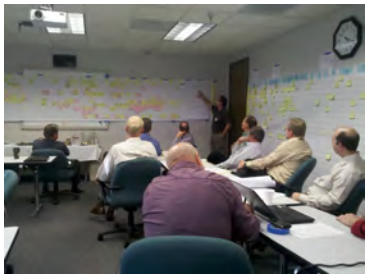
Design Development Challenge

- LPPD – First Experiment, VSM
  - Reflect on Recent Program
  - Identify ‘Pain’ (Waste)
  - Develop Your Next Experiment
- Improvement Cycle
  - Scope Creep – ‘Concept Paper’
  - Batching – Workflow Management
  - Communication – Obeya, Front Load

Timeline & Stickies with key program

‘Swim Lanes’
One for each contributing organization

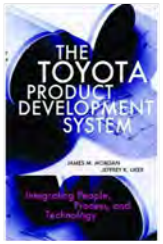




Jeffery Liker / James Morgan

Thirteen Principals, Focused on:

- **People**
- **Process**
- **Tools**



Process
- Customer Defined Value
- Front Load
- Leveled Process Flow
- Standardization

Skilled People
- Chief Engineer System
- Balance Expertise and Integration
- Towering Technical Competence
- Integrate Suppliers
- Culture of Excellence

Tools & Technology
- Adapt Technology to Fit People
- Visual Communication
- Tools for Standardization and Learning

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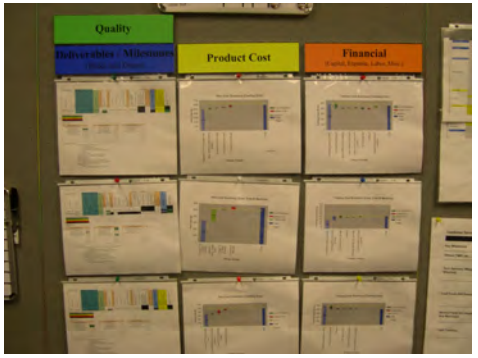
Design / Development Challenge

- Obeya
  - Visible Accountabilities, Plans, Progress, Problems
  - Every Organization Represented and Engaged
  - Front Loading
- Workflow Management
  - Synchronized Flow - Engineering, Supplier, Tooling, Manufacturing . . . Test



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LPPD Benefits (Survey):

Improved Communication, 96% of Respondents
Improved Accountability, 82%
Improved Ability to Meet Deliverables, 74%
Improved Meeting Productivity, 73%

Improved Collaboration, 91%

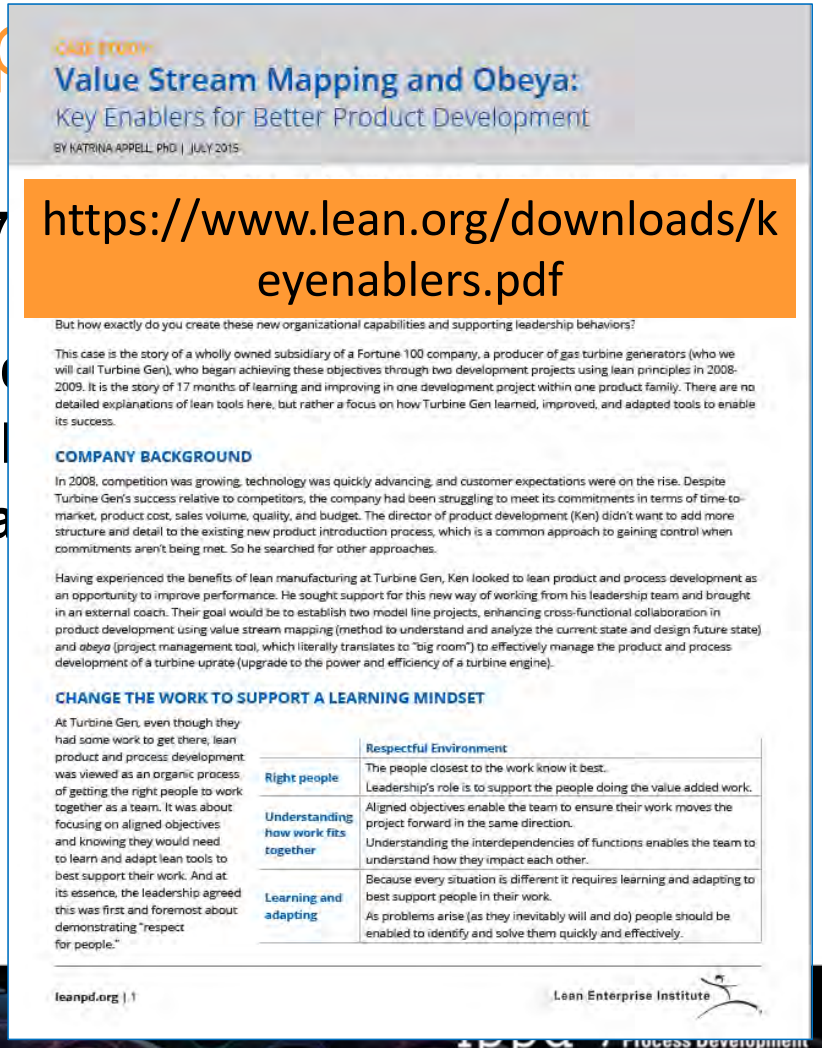
"When people are meeting frequently in the Obeya, it helps them all stay on the same page and see the bigger picture of how their work fits in"

"Accountability by individual / department with forced cross-communication"

". . . it creates more work, but more useful work. Nothing beats strategic communication. . ."

"Creates multi-disciplinary environment to discuss cross-function plans and problems"

"Peer pressure of having data visible to all"



CASE STUDY

Value Stream Mapping and Obeya:
Key Enablers for Better Product Development

BY KATRINA APPELL, PhD | JULY 2015

https://www.lean.org/downloads/keyenablers.pdf

But how exactly do you create these new organizational capabilities and supporting leadership behaviors?

This case is the story of a wholly owned subsidiary of a Fortune 100 company, a producer of gas turbine generators (who we will call Turbine Gen), who began achieving these objectives through two development projects using lean principles in 2008-2009. It is the story of 17 months of learning and improving in one development project within one product family. There are no detailed explanations of lean tools here, but rather a focus on how Turbine Gen learned, improved, and adapted tools to enable its success.

COMPANY BACKGROUND

In 2008, competition was growing, technology was quickly advancing, and customer expectations were on the rise. Despite Turbine Gen's success relative to competitors, the company had been struggling to meet its commitments in terms of time-to-market, product cost, sales volume, quality, and budget. The director of product development (Ken) didn't want to add more structure and detail to the existing new product introduction process, which is a common approach to gaining control when commitments aren't being met. So he searched for other approaches.

Having experienced the benefits of lean manufacturing at Turbine Gen, Ken looked to lean product and process development as an opportunity to improve performance. He sought support for this new way of working from his leadership team and brought in an external coach. Their goal would be to establish two model line projects, enhancing cross-functional collaboration in product development using value stream mapping (method to understand and analyze the current state and design future state) and *obeya* (project management tool, which literally translates to "big room") to effectively manage the product and process development of a turbine uprate (upgrade to the power and efficiency of a turbine engine).

CHANGE THE WORK TO SUPPORT A LEARNING MINDSET

At Turbine Gen, even though they had some work to get there, lean product and process development was viewed as an organic process of getting the right people to work together as a team. It was about focusing on aligned objectives and knowing they would need to learn and adapt lean tools to best support their work. And at its essence, the leadership agreed this was first and foremost about demonstrating "respect for people."

	Respectful Environment
Right people	The people closest to the work know it best. Leadership's role is to support the people doing the value added work.
Understanding how work fits together	Aligned objectives enable the team to ensure their work moves the project forward in the same direction. Understanding the interdependencies of functions enables the team to understand how they impact each other.
Learning and adapting	Because every situation is different it requires learning and adapting to best support people in their work. As problems arise (as they inevitably will and do) people should be enabled to identify and solve them quickly and effectively.

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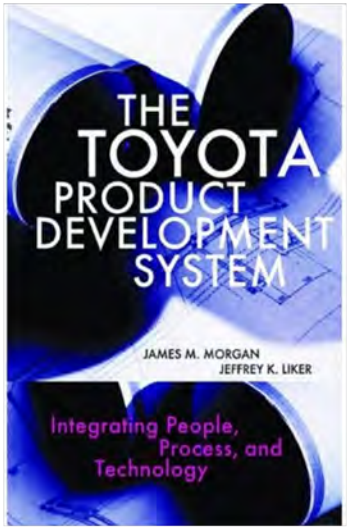
Rapid Expansion of Lean Experiments

- Expanding Our Experiments

Jeffery Liker / James Morgan

Thirteen Principals, Focused on:

- **People**
- **Process**
- **Tools**



Process
- •Customer Defined Value → Value Stream Mapping, VOC
- •Front Load → Early Engagement of Expertise
- •Leveled Process Flow → Kanban, Pull
- •Standardization → Process Improvements, Capture

Skilled People
- •Chief Engineer System → Expanded Accountabilities
- •Balance Expertise and Integration
- •Towering Technical Competence
- •Integrate Suppliers → Suppliers Engaged ('In-House')
- •Culture of Excellence

Tools & Technology
- •Adapt Technology to Fit People
- •Visual Communication → Obeya
- •Tools for Standardization and Learning → Set-Based Engineering, A-3's

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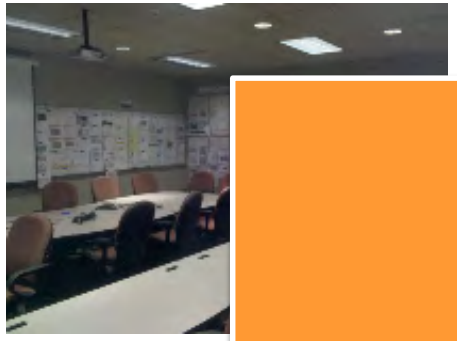
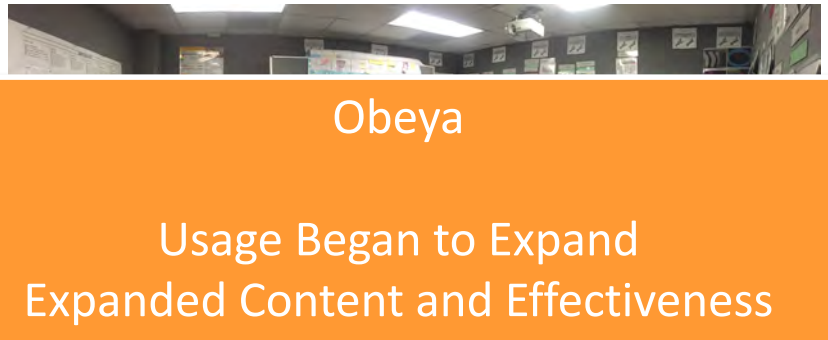
Rapid Expansion of Lean Experiments

Caterpillar



Solar – Turbine Development Team



Solar (Switzerland), Product Support

Obeya

Usage Began to Expand
Expanded Content and Effectiveness

Yet, For Every Successful Obeya More than Four Failed!

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Rapid Expansion of Lean Experiments

- Kanban
  - Leveled Work in the Office – Engineering
  - Queues, Ready Queues, Pull Signal, WIP Cap's

Kanban

Large Workflow Improvements
Change Workflow Environment from 'Push and Chase' to Flow

Yet, for Every Successful Kanban, 20 failed!

Improved Work Alignment
Improved Velocity

Velocity Gains (100%)
Reduced Drawing Errors

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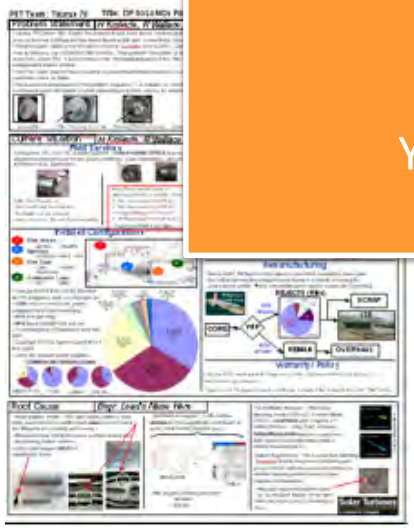
Rapid Expansion of Lean Experiments

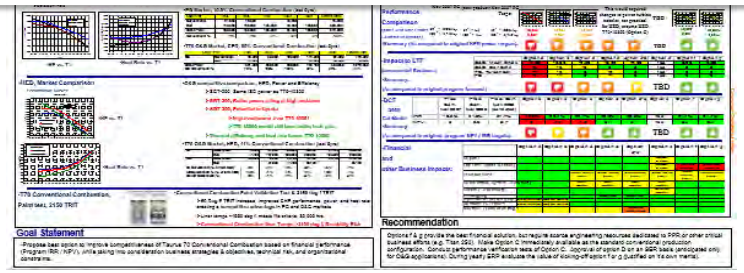
- A-3, Problem-Solving
  - Effecti[illegible]
  - Tool S[illegible]
  - Great[illegible]

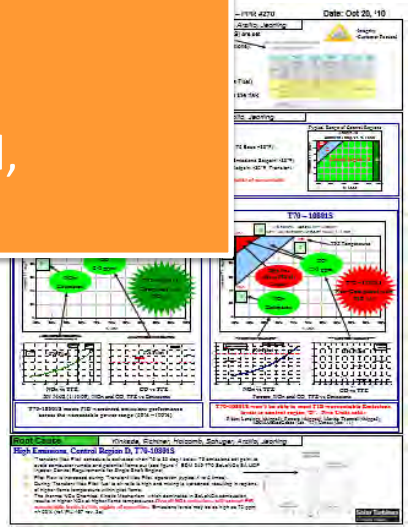
A-3, Problem-Solving

A-3 Methods Used to Solve Difficult and Complex Problems
Extensive Training, 100+ Engineers

Yet, Old Problem-Solving Values Began to Prevail,
A-3's Faded Away







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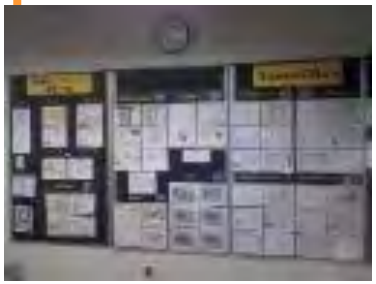
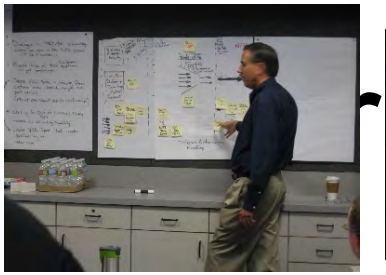
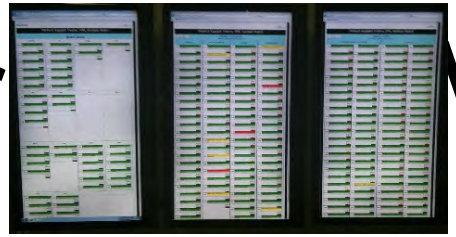
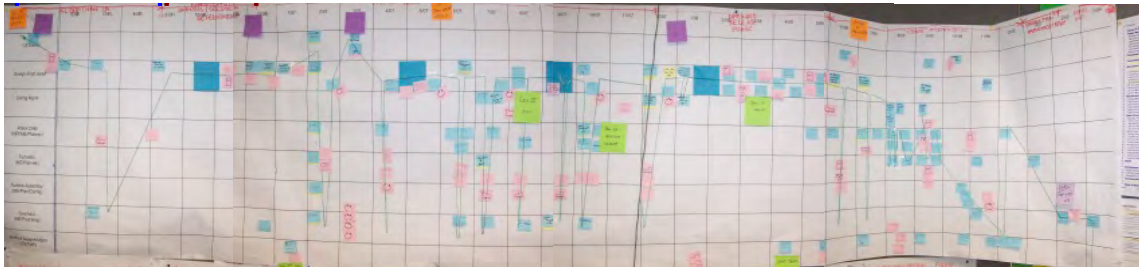
Rapid Expansion of Lean Experiments





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The ‘Big Chill’ and the ‘6th Why’

- Why Weren’t These Gains and Process Improvements – ‘Sticking’

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The ‘Big Chill’ and the ‘6th Why’

Why weren’t we following our new ‘Standard Work’?

aizen Events
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ck to Old Approach

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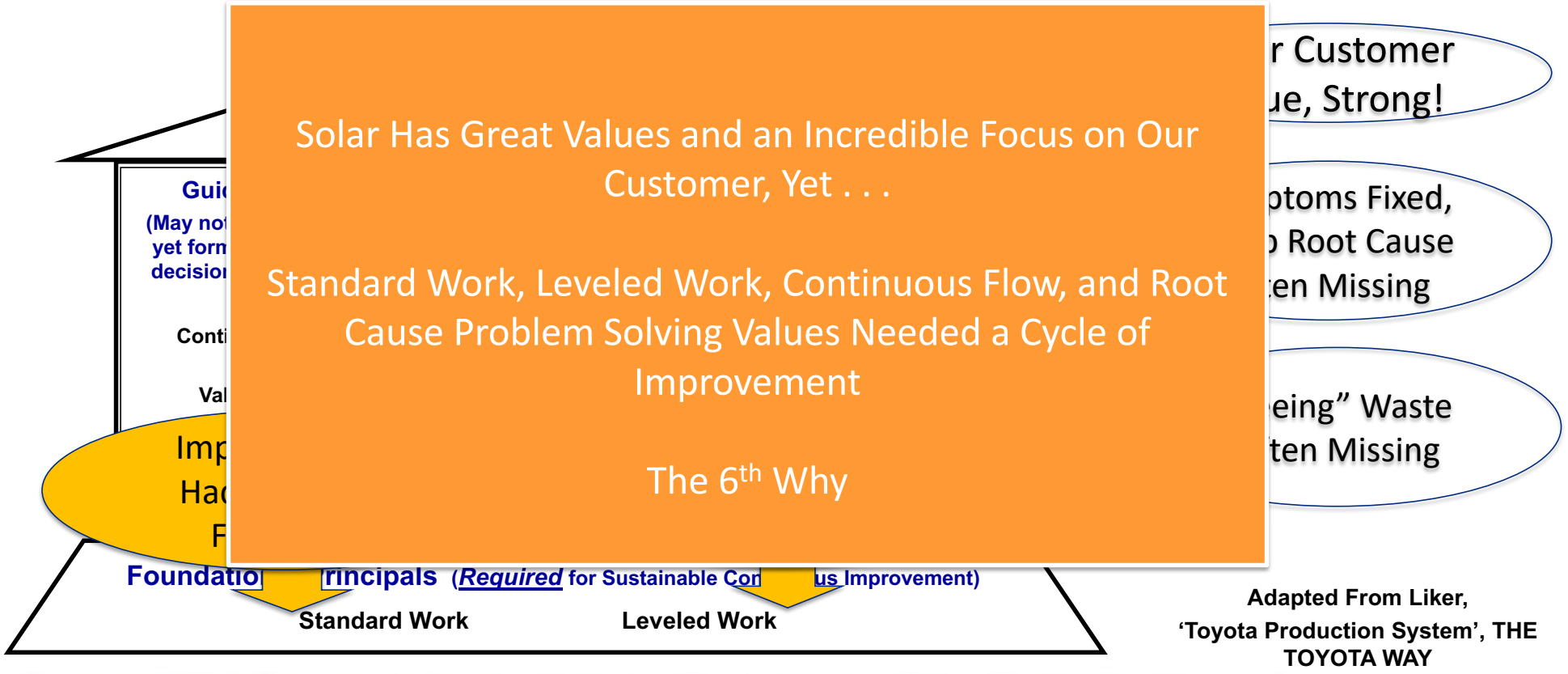
The ‘Big Chill’ and the ‘6th Why’



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Cul

- Gas
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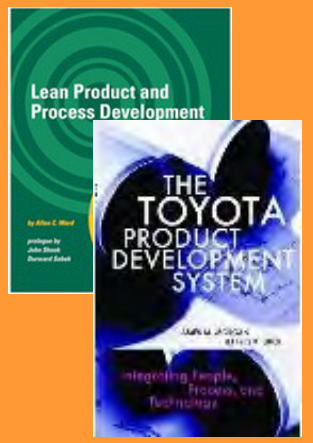
Gas Compressor Business

Competitive Landscape Changing

New Director's Imperative – Accelerate the Rate of Innovation

Where to Start?



Solar Gas Turbine

Solar Gas Compressor

Gas Compressor Test Facility

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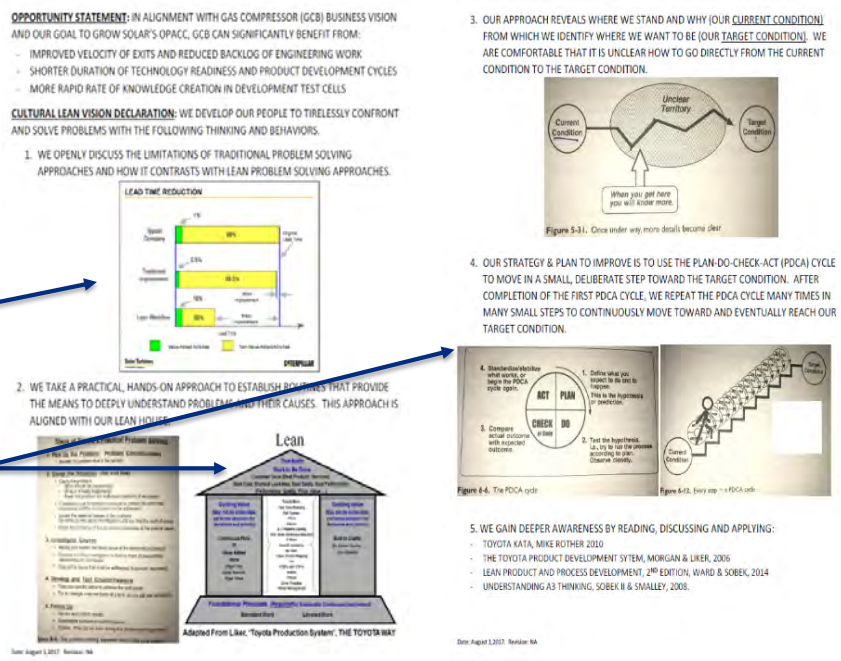
Cultural Revelation and Organizational Evolution

- Cultural Lean Vision Declaration

  “We Develop our People to Tirelessly Confront and Solve problems with the Following Thinking and Behaviors”

- Attention to our Pain (Waste)
- Cultural Values
- Improvement Kata



Cultural Lean Vision Declaration

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Cultural Revelation and Organizational Evolution

- Organizati
  - Re
    - Clarity
    - nformed)
  - Fur
    - hip
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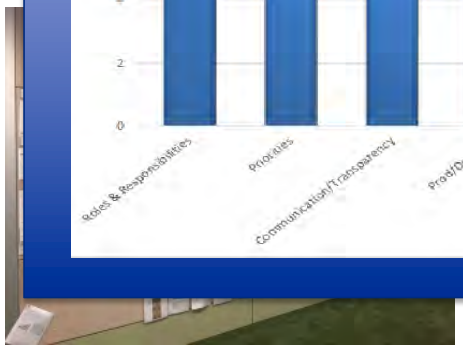
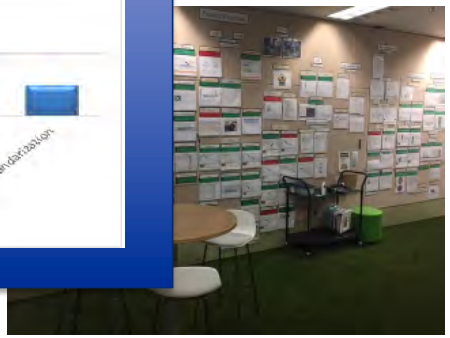
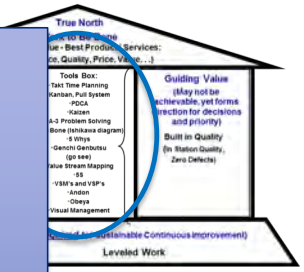
Cultural Revelation and Organizational Evolution

- Visual Communication – Obeya
  - Central C
  - Visual Co
    - Marke
    - Progr
    - Susta
    - Proce







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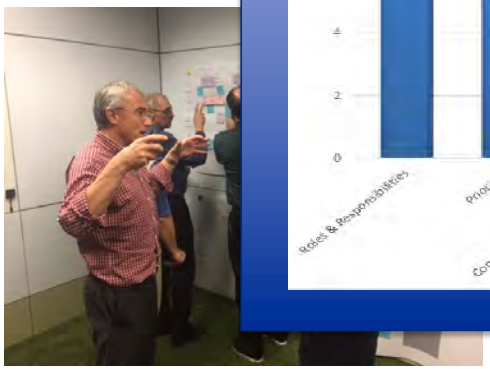
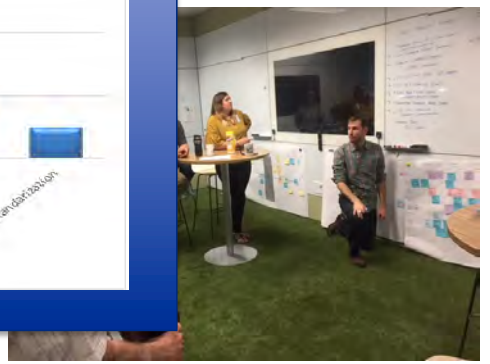
Cultural Revelation and Organizational Evolution

- Continuous Flow of Value Added Work – Kaizen
  - Culture c
    - Value
    - Value
    - Capt





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Cultural Revelation and Organizational Evolution

- Leveled
  - 'Pull'
    - F
    - S
    - F

Gas Compressor's Workflow Management, Jan 2017

Gas Compressor's Workflow Management, June 2018

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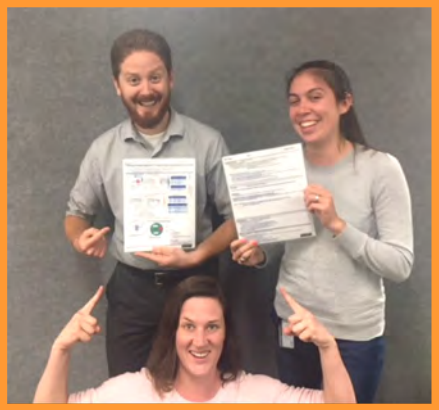
Cultural Revelation and Organizational Evolution

- When I get

  - Focus o
  - Head 'N
  - Reflect
  - Repeat
  - . . .and

Respectful

Yet, Passionately Persistent



Great Problem Solving
Feels Right!

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Questions

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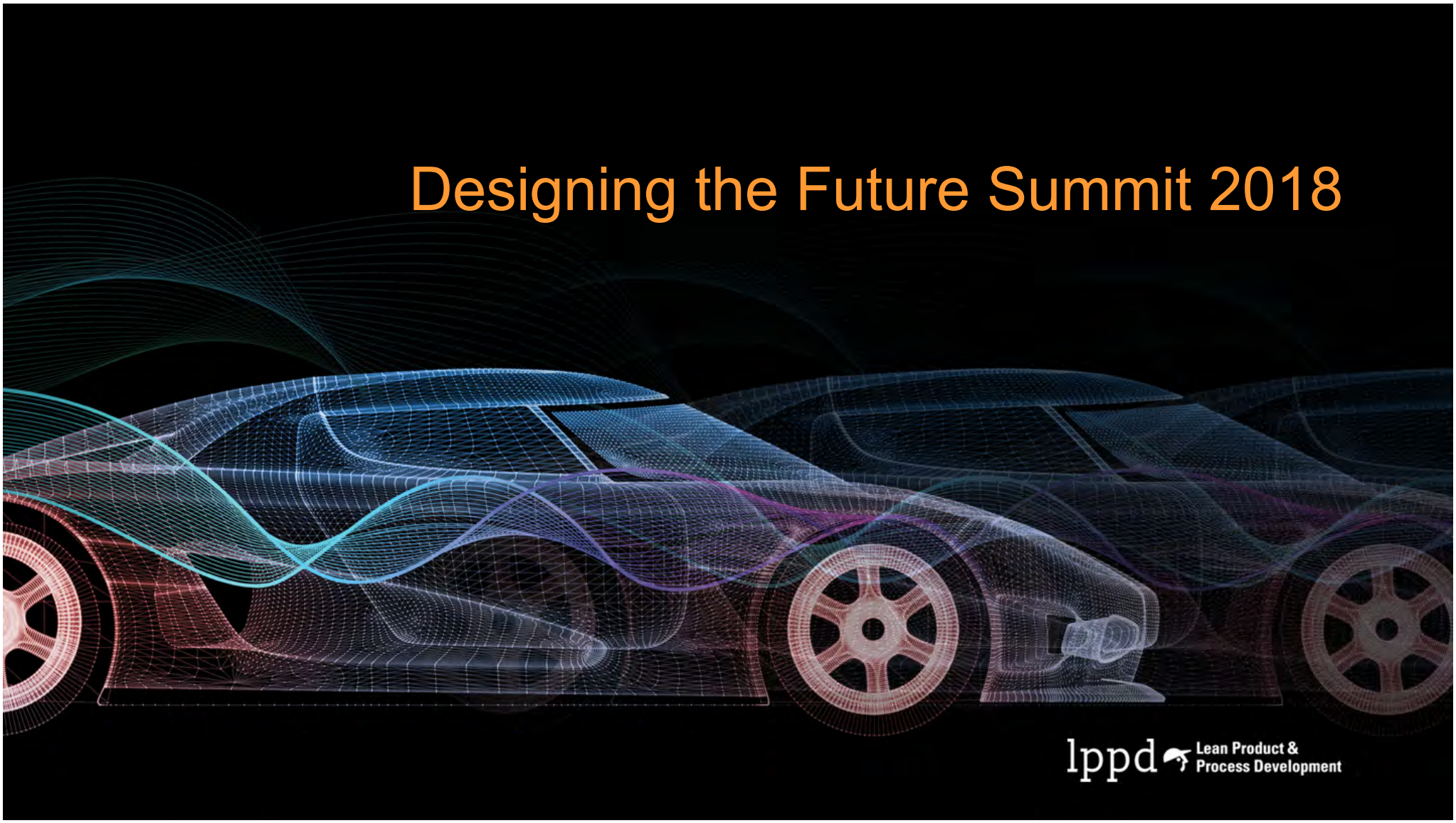
Designing the Future Summit 2018