Lean Thinking

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Overview

- Learning Objectives
  - Awareness of the contrast between “mass” and “lean” mindsets
  - Appreciation of the historical context for lean thinking
  - Ability to engage in lean thinking with respect to application examples (5S’s, 7 Wastes, and others)
  - Appreciation for the dilemmas and challenges in lean implementation
- Session Design (60-90 min.)
  - Two mindsets (7-10 min.)
  - Historical context (10-15 min.)
  - Applications (20-30 min.)
  - Implementation debate (20-30 min.)
  - Concluding comments (3-5 min.)

A visual record of where we are at in this module:

Two mindsets

"Mass Production" Mindset

- Producer "push"
- Movement of materials
- High volume
- Inspection
- Expert-driven
- Decomposition
- Periodic adjustment

"Lean Enterprise" Mindset

- Customer "pull"
- Flow of value
- Flexible response
- Prevention
- Knowledge-driven
- Integration
- Continuous improvement

Where to begin?

- An Exercise in Lean Thinking:
  - Small groups of 2-3 people – each assigned a number
  - Even numbered groups:
    - Describe a home workbench or a student dorm room used by someone engaged in “mass” thinking
  - Odd numbered groups:
    - Describe a home workbench or a student dorm room used by someone engaged in “lean” thinking

Note: An option for this exercise would be to draw a picture on a transparency to illustrate you description

Notes From Student Responses

Mass

- Dorm
  - Basic furniture – bed, desk, shelf, chair
  - All rooms the same
  - Square, long halls and every floor the same
  - Cheapest, reliable chairs
  - Basic cleaning
  - Wireless internet – basic
- Workbench
  - Excess materials, stock
  - Lots of equipment
  - Storage room
  - Products stored in a room
  - More than one bench

Lean

- Dorm
  - Efficient use of space – loft bed and under bed storage
  - Combined desk
  - Aesthetic and everything within reach
  - Modular and reconfigurable furniture
  - Large double pane windows
  - New, “good for you” lights
  - Wireless internet
- Workbench
  - If not used, rent equipment
  - Materials ordered based on projected use
  - Quality materials and equipment
  - Versatile and well organized
  - Ability to design ourselves
  - Ability to repair our own parts
  - Outsource to others if they would be better to do it

Historical context: The changing nature of work

1800 and earlier — *1900* — *2000 and beyond*

Craft Production

Socio: **Decentralized Enterprises**
Mastery of Craft
Tech: **Custom Manufacture**
Specialized Tools

Mass Production

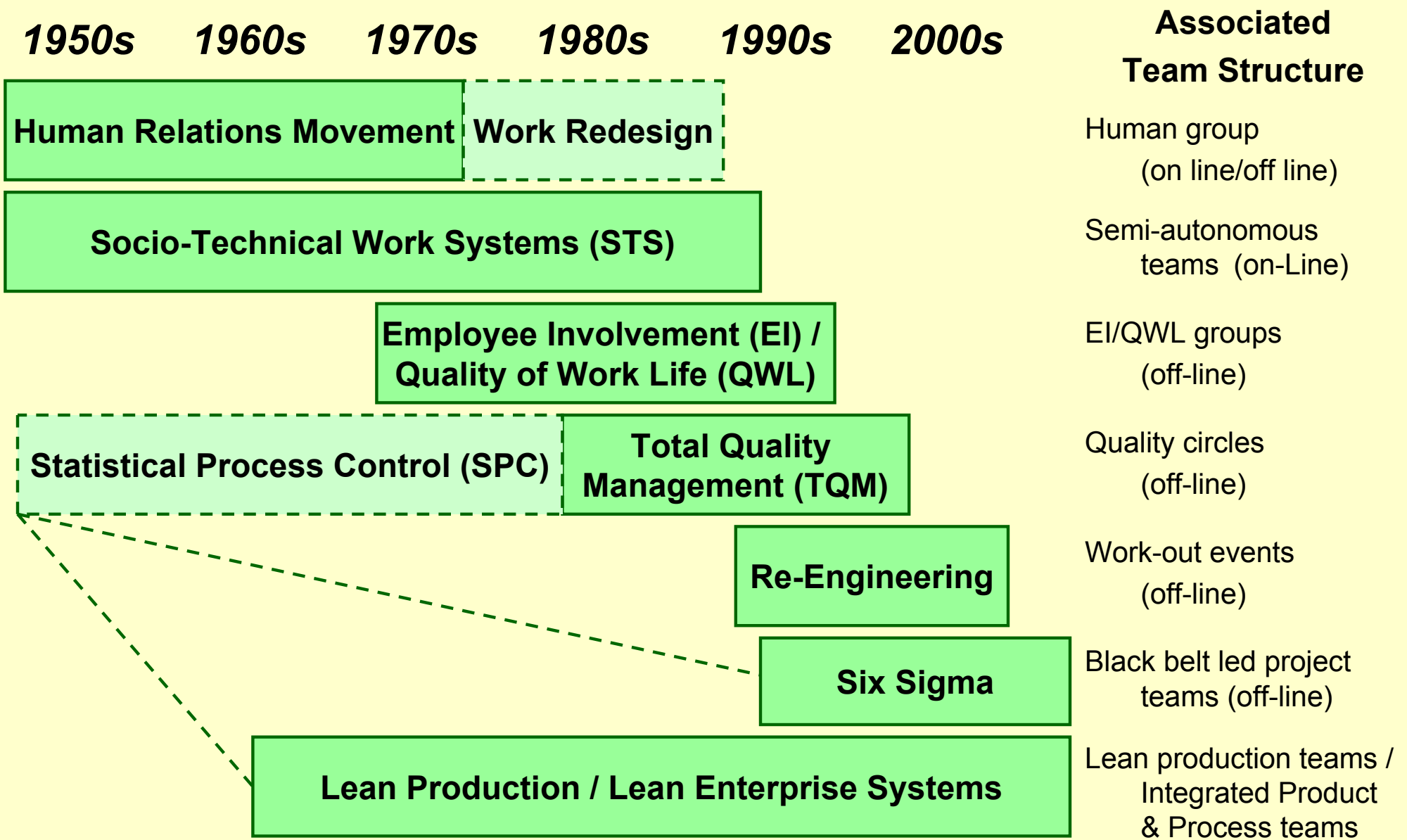
Socio: **Vertical Hierarchies**
Scientific Management
Tech: **Assembly Line**
Interchangeable Parts

Knowledge-Driven Work

Socio: **Network Alliances**
Team-Based Work Systems
Tech: **Flexible Specialization**
Information Systems

Adapted from: "Knowledge-Driven Work: Unexpected Lessons from Japanese and United States Work Practices" (Oxford University Press, 1998)

Historical context: Transformation initiatives



 Source: Auto Industry System Study by Joel Cutcher-Gershenfeld and Thomas Kochan, 2000

Historical context: Emergence of lean

Selected Elements of Toyota Production System Implemented over Three Decades:

- "Pull" vision
- Kanban (card) system
- Production leveling
- Reduced set-up time (Shingo)
- Jidoka (people giving wisdom to machines)
- Statistical Process Control (SPC)
- Quality Circles
- Kaizen (continuous improvement based on knowledge)
- Poka-yoke (error proofing)
- Adnon (visual display)

Case Example – Kanban:

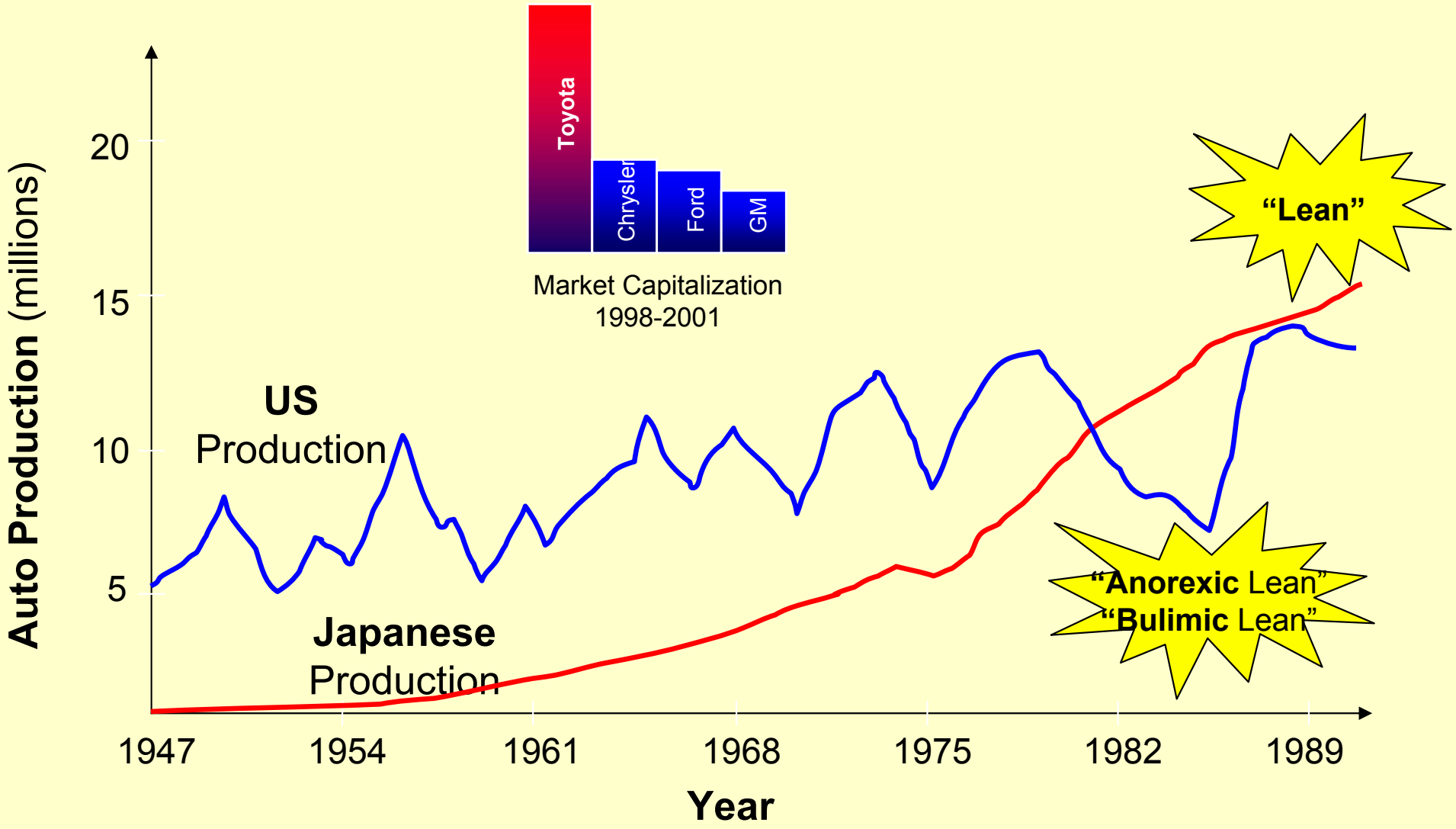
1950s	First kanban experiments
1960s	Kanban introduced company-wide
1970s	Kanban distributed across suppliers

Discussion Question:

- *It took close to 30 years for Toyota to develop all of the aspects of the Toyota Production System, including the lean thinking that goes with that system. How long do you think it might take a large aerospace company such as Boeing or Lockheed Martin or Pratt and Whitney to build the same capability -- 30 years, 20 years, 10 years, 5 years?*

Auto industry data: A lean story?

(data from *The Machine That Changed the World)*

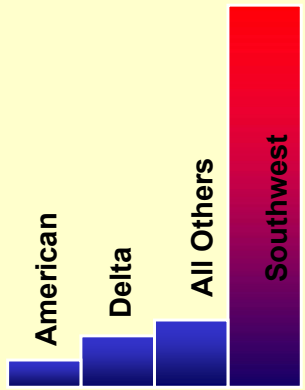


Source: Ted Piepenbrock 2003, Engineering Systems Division Doctoral Seminar, Massachusetts Institute of Technology

1. Data from Womack, Jones and Roos, *The Machine that Changed the World*, The Free Press, 1990.

Airline industry data: A lean story?

(source: IATA & Southwest Airlines)



Market Capitalization
2002

Total Airline Profits
(1970-2002)

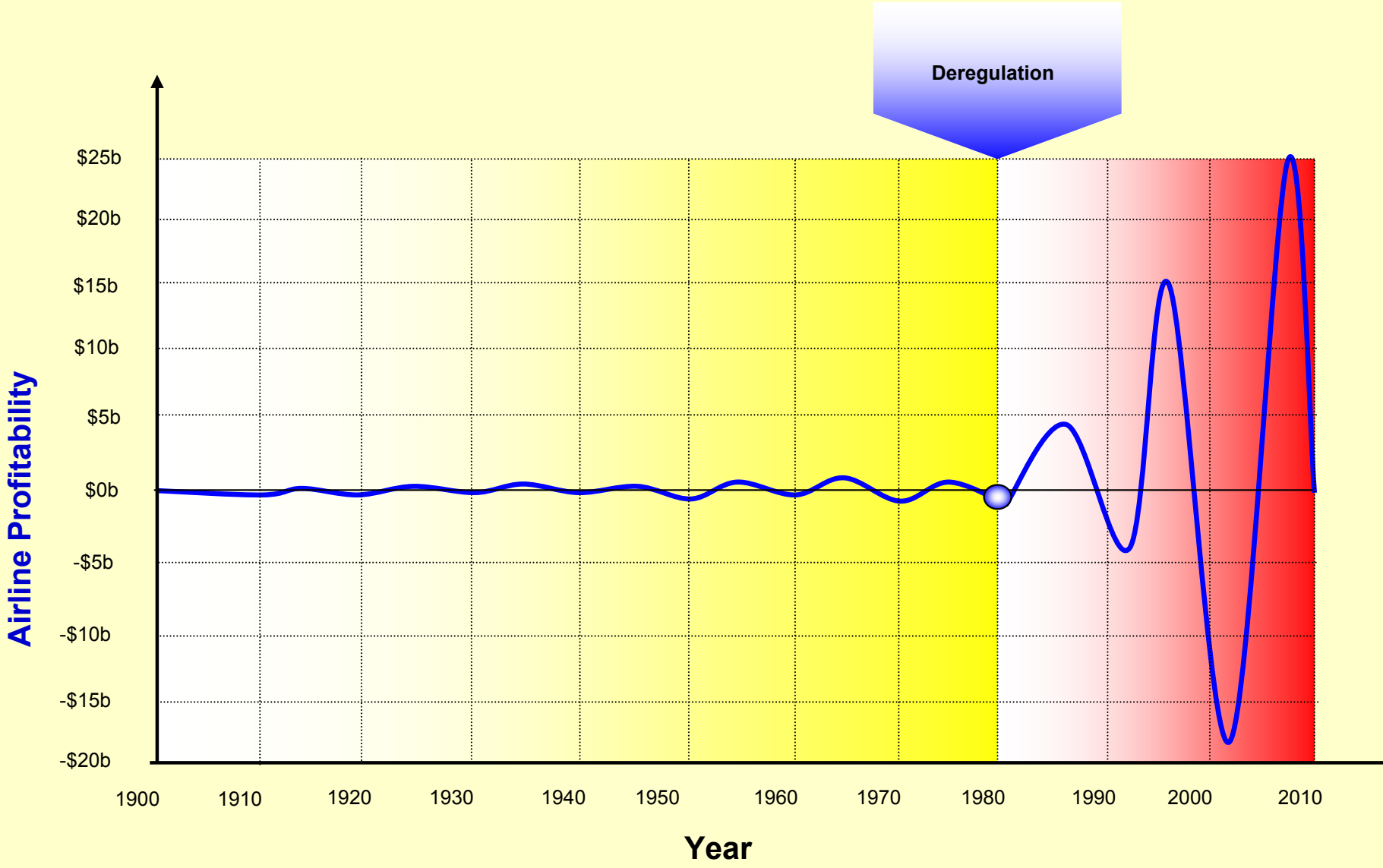
"Higher, Faster, Farther"
Network Carriers
Hub & Spoke Networks
Wide Body Planes

"Better, Faster, Cheaper"
Low-Fare Carriers
Point-to-Point Networks
Narrow Body Planes

Source: Ted Piepenbrock 2003, Engineering Systems Division Doctoral Seminar, Massachusetts Institute of Technology

1. Data from the IATA.

Airline industry data: Another look at the picture



Source: Presentation on "Enterprise Design for Dynamic Complexity: Enterprise Product Strategy" by Ted Piepenbrock at the Lean Aerospace Initiative Product Development Community Meeting, (October, 2003)

Lean thinking: A mental model

Womak and Jones:

- Specify value
- Identify the value stream
- Make value flow continuously
- Let customers pull value
- Pursue perfection

Source: James P. Womak and Daniel T. Jones, Lean Thking, New York: Simon and Schuster, 1996.

Exercise: The Seven Wastes and the Five S's

The Seven Wastes

- Over Production
- Waiting
- Transportation
- Inventory
- Processing
- Motion
- Defects

The Five S's

- Simplify or Sort
- Straighten or Simplify
- Scrub or Shine
- Stabilize or Standardize
- Sustain or Self-Discipline

What changes are needed in technical/physical systems to address the Seven Wastes?

What changes are needed in social systems – including what new ways of thinking?

Do the same analysis with respect to the Five S's

Analysis - Student Responses

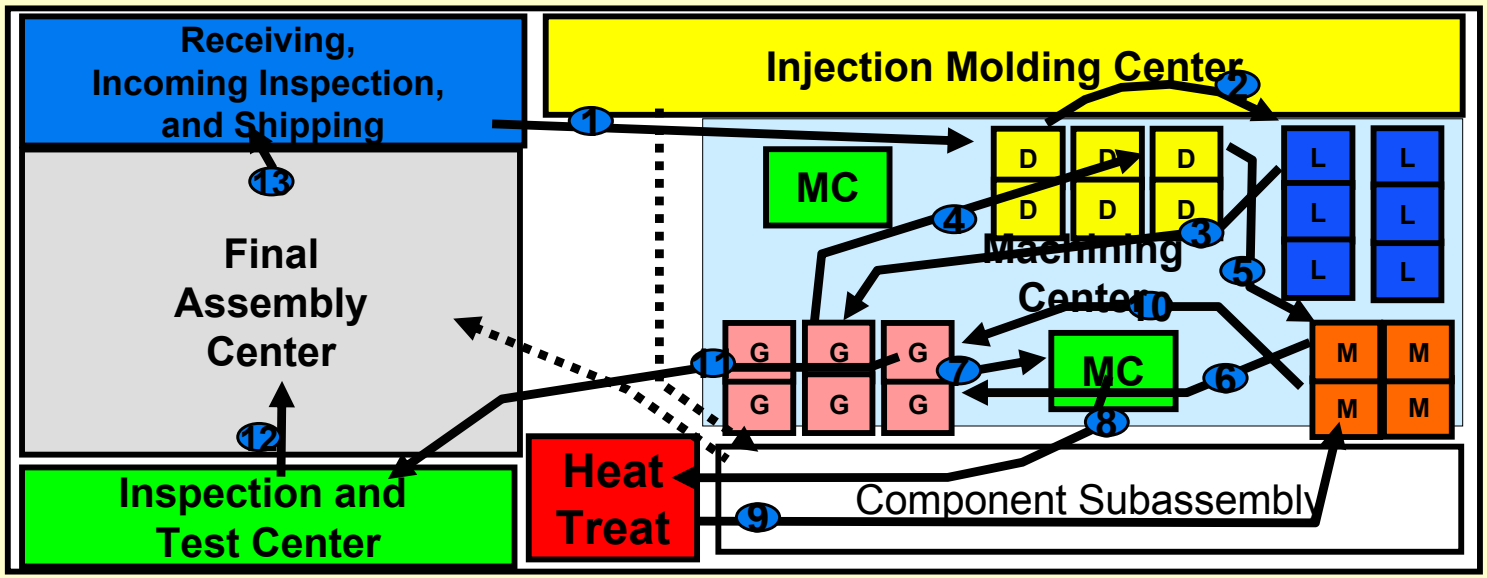
Seven Wastes

- Technical
  - Moving assembly line to reduce waiting
  - Smaller racks to hold inventory
  - Sensors when you use parts – signaling to material handlers
  - Building architecture to support teamwork
- Social
  - Build quality into each job – so you don't need the inspector
  - Incentives – to reduce waiting time – reward and recognition

5S's

- Technical
  - Different functional areas with support across all programs – sort and standardize
  - Bar codes to track parts
- Social
  - Incentives
  - Get the word out – posters, training, memos
  - Encourage communications directly between groups
  - Individual responsibility

What lean thinking goes into work cell redesign?

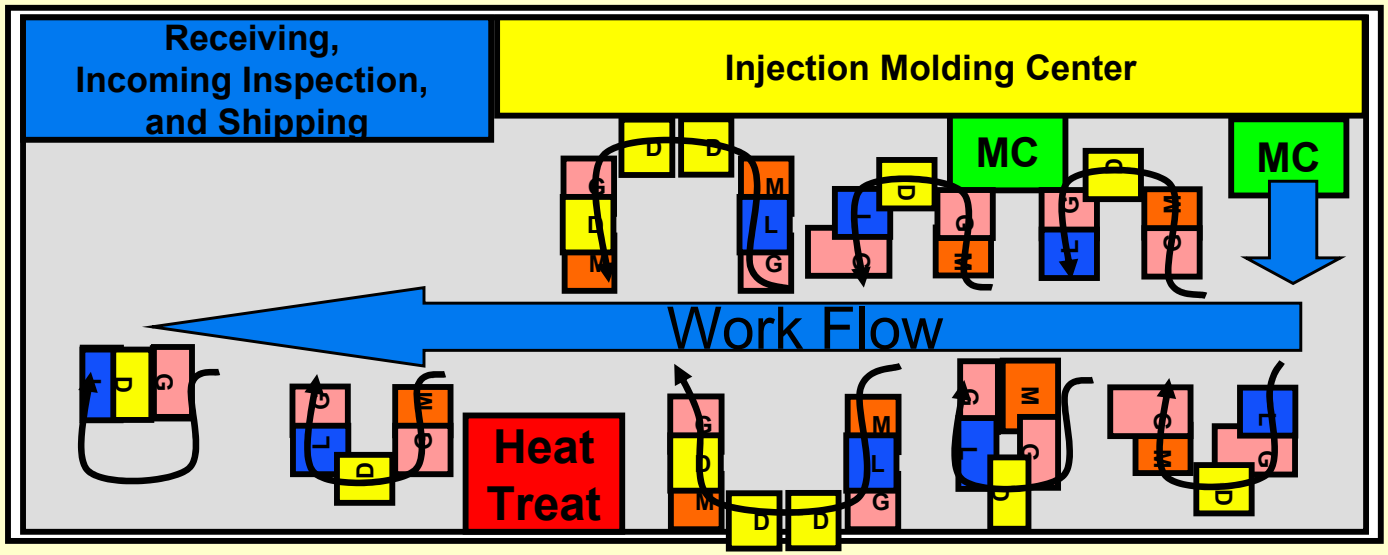


Current State

(Specialized tasks, separate inspection and material handling)

Desired State

(Integrated tasks, inspection and material handling)



Source: Lean Aerospace Initiative Fieldbook

Lean implementation strategies

Top-Down "Re-engineering"

- ***Many meanings:***
  - Range from a pretext for restructuring and downsizing to a systematic review of operations with comprehensive process mapping
- ***Key quote:***
  - *"if it's not broke, break it"*
- ***Roots:***
  - Roots in private and public sectors, including "re-inventing government"
  - First driven by economic crisis in 1980's, now seen as a process for system change
- ***Archetypical Example:***
  - GE "workout" process

Bottom-up "Kaizen"

- ***Many meanings:***
  - Range from suggestion systems (kaizen-teian) to an underlying philosophy and a way of life
- ***Key quote:***
  - *"many small improvements build long-term transformation capability"*
- ***Roots:***
  - Post WWII Japan, beginning with quality circles (QC), statistical process control (SPC), and just-in-time (JIT) delivery practices
  - Increasingly seen from a systems perspective -- Total Quality Management (TQM), Six Sigma, Lean Enterprise
- ***Archetypical Example:***
  - Toyota Production System (TPS)

"Kaizen event" – A contradiction in terms?

It's a debate! Lean implementation

- Kaizen versus re-engineering
  - **Pro:** *In general, for large-scale lean implementation initiatives, the incremental, bottom-up kaizen approach will be the most effective*
  - **Con:** *In general, for large-scale lean implementation initiatives, the revolutionary, top-down re-engineering approach will be the most effective*

- Debate format:
  - Opening Statements (1 min.)
    - Within team consultation (1 minute)
  - Rebuttal (2 min.)
    - Within team consultation (1 minutes)
  - Closing Statements (1 min.)

Lean Implementation
Notes from Student Responses

Re-Engineering

- Top-down sets a strong foundation so you can make faster change
- A clearer focus, unlike bottom-up time on minor details
- Top-down will get change done
- Address all at once, so faster

Rebuttal

- Harder to integrate lower level – that is why you need top management
- Doing the job right or doing the right job
- Not just the easy changes first
- Don't get overall benefits
- Just islands of success
- May not be enough time

Kaizen

- Elimination of typical top-down communications problems
- Quicker because directly involves the worker
- Increased self-esteem
- Spiral development with feedback

Rebuttal

- You said it was stronger foundation, but not true – keep destroying the foundation
- One system with constant improvement
- A better focus
- Employees are the ones driving this
- What if you go fast and mess up?
- Top management is needed for integration
- If isn't not broken, keep on improving

Conclusion

- Contrast between “mass” and “lean” mindsets
- Historical context
  - “Lean” as a form of knowledge-driven work
  - Lean as an emergent phenomena
- Applications
  - Lean thinking required for the Seven Wastes, the 5S’s, work cell design, Value Stream Mapping, and other applications
- Implementation
  - Kaizen vs Re-engineering
- Learning to see “waste” and “value”

Appendix: Systems Change Initiatives

- Work-Process Centered Systems Change Initiatives
  - Taylorisim, Industrial Engineering and Work Redesign
  - Socio-Technical Systems Redesign
  - Worker Participation and the Human Relations Movement
  - Team-Based Work Systems
- Relationship-Centered Systems Change Initiatives
  - Strategic Alliances
  - Joint Ventures
  - Labor-Management Partnerships
  - Customer-Supplier Partnerships
- Outcome-Centered Systems Change Initiatives
  - Quality Initiatives (Total Quality Management, Six Sigma, etc.)
  - Lean Initiatives (Lean Manufacturing, Lean Enterprise, etc.)

Appendix: Systems Change Initiatives (cont.)

- Business Process-Based Initiatives
  - Process Re-engineering
  - Activity-Based Costing (ABC)
  - Enterprise Resource Planning Systems (ERP)
  - e-business Initiatives
- Structural, Policy and Market-Driven Systems Change Initiatives
  - Organizational Restructuring
  - Mergers and Acquisitions
  - Privatization
  - Regulation and De-Regulation of Markets
- Technology-Driven Systems Change Initiatives
  - New Technology Implementation
  - Material and Method-Driven Transformations
  - Research and Development Commercialization