LEADING IMPROVEMENT ACROSS A COMPLEX AEROSPACE ENTERPRISE

Dick Lewis, COO Rolls-Royce Corporation 2001-2004

© 2007 Dick Lewis, used with permission
Presentation Contents

• Key components which drive enterprise improvement
• Essential tools for business improvement
• Typical business improvement metrics
• Improvement as a process rather than an end state
Rolls-Royce Corporation

- Founded in 1915 by James Allison
- Produced over 110,000 engines powering P38, P-51, A7, OH-6, OH-58, C-130, C-2, P-3, E-2, ERJ145, V-22
- First true multi-application engine, the AE Family: Fan, Propeller, and Shaft Driven
- Over 50 regional airline systems and hundreds of corporate operators in five continents
- Approximately 30,000 engines currently in service for civil, military, helicopter, energy, and naval applications
- Acquired by Rolls-Royce plc in 1995
Rolls-Royce Corporation
Key Statistics - 2004

4 Business Sectors
  (Civil Aerospace, Defense, Energy, Marine)
3 Major Product Families (AE, T56/501, 250)
2 Engines/day
$1M Spares/day
4,400 People, including 1950 UAW members
3,000,000 Sq. Ft. Active Floor Space
2,700 Active Machine Tools
7,000 Active Part Numbers
$1.5B Annual Sales
$250M Rolls-Royce Plant Improvement
4 Years Into Lean Journey
Rolls-Royce Stakeholders

- 1000’s of users and maintainers
- 100’s of buying customers
- 10’s of partners
- 4400 employees
- 300 suppliers
- Federal, state, and local governments
- 1000’s of shareholders
- Rolls-Royce plc leadership
- United Autoworkers Union
- Community neighbors
Improvement That Flows to the Bottom Line Requires

- Vision
- Focus on Customers and Employees
- Active Leadership Involvement and Alignment with Workforce
- Willingness to Break Established Paradigms
- Hierarchy of Trained, Empowered, and Incentivized Employees
- Constancy of Improvement Activity
- Celebrate and Reward Success
Rolls-Royce
Corporation Vision

• Trusted to Deliver Excellence
  • As determined by customer satisfaction
  • And measured by a few understandable metrics
  • Supported by a workforce trained and empowered to deliver improvement
  • Across the entire business
Leadership From the Top

- Motorola - John Galvin
- GE - Jack Welsh
- Allied-Signal - Larry Bossidy
- ITT - Lou Giuliano
- Boeing – Jim McPherney
- Rockwell Collins – Clay Jones
Knowledge is Required to Deliver

- Capable, world-class processes
  and
- Streamlined, value-adding activity
Hierarchy of Knowledge

• Team and Leadership Skills

• Knowledge-based “Belts” - Yellow, Green, Black – in lean and six sigma

• Certified Mastery - ASQ

• Sensei - e.g. Genichi Taguchi at ITT
Essential Tools for Business Improvement

1. **Define**
   - Charter
   - Customer needs, requirements
   - High-level process map

2. **Measure**
   - Process flow map
   - Data acquisition plan
   - Plan implementation

3. **Analyze**
   - Data analysis
   - Process analysis
   - Root cause analysis

4. **Improve**
   - Solution generation
   - Solution selection
   - Solution implementation

5. **Control**
   - Control methods
   - Response plan

---

Lean Academy

Dick Lewis Enterprise Talk V6.6 - Slide 11
© 2007 Dick Lewis used with permission
Essential Tools for Business Improvement

- **Define**
  - High level process map
  - Problem definition
  - Metrics
  - Improvement goals

- **Measure**
  - Process analysis
  - Probability and statistics
  - Data collection and analysis
  - Measurement systems
  - Process capability
Essential Tools for Business Improvement

• **Analyze**
  - Data analysis
  - Hypothesis testing
  - Lean concepts and tools
  - Quality function deployment
  - Fault tolerant design
  - Failure mode and effects analysis
  - Design for X

• **Improve**
  - Non-value added elimination
  - Kaizen
  - Design of Experiments
  - Taguchi methods
Essential Tools for Business Improvement

• Control
  • Statistical process control
  • Poka-yoke
  • 5S
  • Visual factory
  • Andon
  • Kanban
  • Muda
  • Total productive maintenance
Rolls-Royce Metrics Focus on Stakeholder Issues

• On-time delivery
• Delivered product quality
• First pass test yields
• Past due receivables
• Return on Invested Capital
Lean Initiatives at Rolls-Royce

- Initial Factory Kaizen Activities
- PIF & PIL Training
- Flow Line
- Supplier Quality Initiatives
- Supply Chain Restructuring
- Non-Value Added Elimination
- Cash Collection
- Transactional Black Belts
- Single Process Initiatives
- Project Evolution
First Year Actions

• Mobilized leadership team
• Agreed on vision
• Set priorities
• Established metrics
• Reassigned key leaders
• Streamlined process flows
• Focused on attributes data
• Invested to remove bottlenecks
First Year Results

- Significantly improved on-time delivery
- Step improvement in delivered product quality
- Increased 1st pass test yields by 4%
- Reduced cost of nonconformance by 3%
- Eliminated 500 obsolete machine tools
- Halved overage government contracts
- Eliminated 25% of chart of accounts
- Contributed significant profit and cash to Rolls-Royce plc
- Earned significant incentive compensation for all employees
Second Year Actions

• Reaffirmed prior year priorities
• Initiated cash collection team
• Began assembly flow line
• Hired third party parts supplier
• Began training workforce in lean, continuous improvement
• Increased working with suppliers
Second Year Results

- On-time delivery approached acceptable levels
- A second stepwise improvement in delivered product quality
- Reduced cost of non-conformance by 10%
- Eliminated overage government contracts
- Reduced delinquent receivables by 50%
- Initiated formal customer satisfaction measurement across business
- Delivered record profit and cash to Rolls-Royce plc
- Earned incentive compensation for all employees
Third Year Actions

• Fine tuned priorities
• Multi-skill training for 50% of shop floor employees
• Completed assembly flow line
• Razed 800,000 sq ft of obsolete facilities
• Began third party logistics efforts
• Trained transactional (office) black belts
Third Year Results

• Significant volume reduction post 9/11
• On-time delivery and delivered product quality stalled
• Cost of non-quality reduced by 18%
• Customer satisfaction index improved by 2%
• Halved engine assembly cycle time
• Achieved world class cash collection results
• Delivered significant profit and cash to Rolls-Royce plc
• Earned significant incentive compensation for all employees
Fourth Year Actions

- Increased emphasis on quality
- Completed shop floor multi-skill training
- Began third party logistics implementation
- Completed majority of factory renovation
- Changed COO but not vision
Fourth Year Results

- On-time deliveries improved
- Delivered product quality and cost of non-quality static
- Customer satisfaction improved
- Profit and cash generation ahead of targets
- Earned significant incentive compensation for all employees
Fifth Year Actions

• Negotiated breakthrough contract with UAW
  • But this distracted leadership from many components of enterprise business improvement

• Leadership team changes – planned and unplanned
  • Loss of momentum in key areas of Operations, Manufacturing and Quality
Fifth Year Results

- Implemented new labor contract which increases competitiveness within aerospace industry
- Sustained improvements in business metrics and customer satisfaction with new leadership team
- Awarded multi-billion F-136 engine contract for Joint Strike Fighter
- Earned incentive compensation for all employees
Other Beneficial Results

- Active Charge Numbers from 22,930 to 6,593
- Monthly Aircraft on Ground Claims from 701 to 153
- Open Material Review Board Folders from 390 to 195
- Monthly Financial Report Pages from 630 to 120
- SAP Exception Messages from 18,000 to <6,000
- Part Numbers in SAP from 42,087 to 25,390
- Cost centers from 544 to 442
- Eliminated over 500 procedures by adopting Rolls-Royce Quality Management System
- Reduced accounts payable transactions from 80,000 to 50,000 per year
More Beneficial Results – A 5-year Journey

• Inputs
  • Annual employee training increased 10%
  • Transitioned to a multi-skilled hourly workforce
  • Modernized over 50% of facility
  • Employees empowered to earn significant incentive compensation

• Outputs
  • Cycle times reduced by >2/3
  • Inventory turns improved 40%
  • Cost of non-quality halved
  • On-time deliveries reach benchmark levels
  • Customer satisfaction improved 50%
Benefits to Rolls-Royce

- Eliminated chronic customer dissatisfaction
- Reversed pattern of mediocre financial performance and generated record cash and profit
- Secured future lines of business
- Contributed several “best practices” which have been deployed world-wide
Barriers to Change

- Underground resistance
- Skepticism
- “Just another initiative”
- “It will pass”
- Upsets the status quo
- Takes people out of their comfort zone
Breaking Down the Barriers

- Define the “burning platform”
- Work to obtain buy-in from key stakeholders
- Communicate, communicate, communicate
- Dispatch the resistance
- Reward results
Observations

- Improvement is a journey – not a destination
- Business conditions will change along the way
- Constancy of leadership intent is key
- The better you get – the more there is to do