Lean Effects on Aerospace Programs
Boeing 737 Fuselage
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Boeing 737 Fuselage

- Longest continuous production line in commercial aircraft history
  - Over 4000 aircraft delivered
    - 5 Classic models (-100 ~ -500)
      - Launched in 1965
    - 6 Next Generation models (-600 ~ -900, BBJ, Combi)
      - First delivered in 1997
      - Passenger capacity of 110 to 177
      - Range from 1540 to 6200 miles

737 is a ‘Best-Selling’ Aircraft
737 Next Generation conceived in 1993
- Increasing competition from MD-90, A320, 737 Classic!

High demand leads to large production commitment from Boeing

Critical mass was achieved in 1996
- Change required to keep up with production rates

2001: Set industry record of most pounds of aircraft produced on a monthly basis

“Crisis” of large order backlog!
Significant Firsts

- First model 900 introduced at lower unit cost than 200th model 800 preceding it
- 21% less build flow from Classic to Next Generation models

From 1998-2001

- Rework and repair costs reduced by 50%
- Total Unit Cost
  - Reduced by 25%
  - Expect additional 25%
COMPARISON BY AIRPLANE - UNIT TIME
BOEING COMMERCIAL AIRPLANE GROUP, WICHITA DIVISION

737 CLASSIC (total)
737 NG (Total)

737NG 40.8% Improvement

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Results

Before

After
Key Enablers, Processes, and Practices

- CATIA design and Determinant Assembly
- Collocated Integrated Product Teams with all functional disciplines on the shop floor
- New organization and strong Lean Champion
- Extensive Lean Training (% personnel in divisions)
  - Lean Basics Training 80-90%
  - Lean Production Systems Academy 30-80%
    - 100% of first wave change agents
  - Training in Standard Operations 20-60%
    - 100% of Management Team
- Use of Value Stream Organization
Key Enablers, continued

- Implemented LESAT alpha
  - Modified to meet their needs
  - Used to determine progress towards 100% Lean proficiency
- Investment exceeding $100 mil. in capital equipment
  - 19 Automated Riveters
- Total Productive Maintenance and Flow Production implemented with Autonomous Maintenance and Accelerated Improvement Workshops
  - Ensure that equipment breakdowns do not cause production bottlenecks
Major Findings

- Crisis initiated lean
  - Internal and external motivators for change
- Strong leadership has motivated change
- Investment in new technologies has paid off!
  - Strategic blend of Technology, Design, and Process improvements
    - Automation, Innovation, Autonomation, and Standard Work
    - Through leaders who personally engage through coaching and teaching

“Necessity is the mother of invention”
Major Findings

- Knowledge at all levels is a powerful tool
  - Development of change agents at all levels
  - Educated in not only ‘process’ kaizen methods but also in ‘system’ kaizen
  - Focus on rapid response to problems

- Significant improvements in all metrics
  - Cost, Quality, Delivery, Safety, and Morale
    - Operational performance, people development, and system maturity
Concluding Observations

Future Challenges:
- Downshifting production rates
  - Maintain unit cost while minimizing workforce reduction
  - Sustaining gains in a declining economic environment
- Apply knowledge to other products—757, 767, 777, KC-135, B-52, C-17—even the Sonic Cruiser!

Main Findings:
- Strong leadership AND practical knowledge of lean principles at all levels is crucial
- ‘Crisis’ of large backlog accelerated change

737 NG raises the bar of Lean success