Samlesbury site & lean manufacturing

Frank Hayden
Integrated Operations Director
Samlesbury Site

- 4,500 people, Airframe design and manufacturing, In-service aircraft support

- Track record of international partnerships with Harrier, Tornado, US Navy Goshawk, Typhoon, Airbus, F-35 Lightning II

- High technology machined parts, composites, hot form, fully equipped major units
Typhoon

Fully equipped major units to four final assembly lines:
- Warton, UK
- Manching, Germany
- Turin, Italy
- Madrid, Spain

Tranche 1  148 Aircraft  (UK 55)
Tranche 2  236 Aircraft  (UK 89)
Tranche 3  236 Aircraft  (UK 88)
Design & Manufacturing Integration

- Rapid time to market, accelerating learning curves
- 153 Typhoon aircraft sets delivered to four Final Assembly lines since 2003
- Manufacturing technologies ~ a competitive advantage for F-35 Lightning II
F-35 Lightning II

- Center Fuselage
- Weapons Bay Door Drives
- Arresting Gear
- Carrier Version (CV) Control and Test
- Radar
- Software
- Low Observable Support System
- Training Courseware and Management Systems

- Aft Fuselage
- Horizontal & Vertical Tails
- Fuel System
- Crew Escape & Life Support
- Prognostics Health Management Integration
- CVF Integration Support
- Autonomic Logistics and Global Sustainment
- Mission Systems
- EW System
- Vehicle Management Computer

- Air System Verification
- System Integration
- Mate Through Delivery
- Edges & Control Systems
- Autonomic Logistics
- Mission Systems
- Vehicle Systems
- Training System
- Forward Fuselage
- Wing
Technology Developments

– Single piece machined parts, replace labour intensive fabrications
– Superplastic formed Titanium assemblies - “no joints”
– Composite surfaces machined to 22 microns
– Result: Typhoon & F-35 Lightning II airframe up to 40% lighter than Tornado
Factory Design

- Factory layout to suit single piece flow at build rates of one aircraft a day
- TAKT adherence guaranteed by Pulse Lines, Moving Lines, and Support Cells
- Clear visibility of achievement, team members focused on Continuous Improvement
Airbus High Rate Production

Moving Line concept

- 90% improvement in Parts Quality (from 10,000 ppm errors to <1,000 ppm)
- 5% year on year cost reduction
- Supplier schedule adherence driven much closer to 100%
  (98% not acceptable as 20,000 ppm are late!)
Investment Plan

- £90million of infrastructure completed, further just-in-time investments planned.
Samlesbury Blue Sky Vision

<table>
<thead>
<tr>
<th>SAFETY</th>
<th>QUALITY</th>
<th>COST</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
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<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>PEOPLE</th>
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<tr>
<td><img src="image4.png" alt="Diagram" /></td>
<td><img src="image5.png" alt="Diagram" /></td>
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**Effective Production Planning & Logistics**
## Performance Management System

### Weekly Operations Review

Fortnightly review of Blue Sky Transformation projects

<table>
<thead>
<tr>
<th>Item</th>
<th>2005</th>
<th>Actual</th>
<th>2006</th>
<th>Target Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>YTD</th>
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<tbody>
<tr>
<td>Incident rate per Thousand Employees</td>
<td>84.8</td>
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<td>80</td>
<td>4.30</td>
<td>7.39</td>
<td>7.80</td>
<td>4.70</td>
<td>4.50</td>
<td>7.46</td>
<td>6.35</td>
<td>42.50</td>
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<td>Customer satisfaction (External issue to customer)</td>
<td>?1</td>
<td></td>
<td>1</td>
<td>2</td>
<td>9</td>
<td>98</td>
<td>176</td>
<td>426</td>
<td>522</td>
<td>654</td>
<td>783</td>
<td>891</td>
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<tr>
<td>Site Cost of Quality (£) (not including JSF)</td>
<td>£9m</td>
<td></td>
<td>£8.54m</td>
<td>0.57M</td>
<td>1.16M</td>
<td>1.84M</td>
<td>2.5M</td>
<td>3.34M</td>
<td>4.02M</td>
<td>4.54M</td>
<td>4.54M</td>
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<tr>
<td>Number of MEQNs raised against Typhoon Assemblies</td>
<td>N/A</td>
<td></td>
<td>462</td>
<td>325</td>
<td>431</td>
<td>431</td>
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<tr>
<td>Sales revenue per employee (including overtime)</td>
<td>£7000/mth/emp</td>
<td></td>
<td>£7,250</td>
<td>12,400</td>
<td>4,400</td>
<td>10,100</td>
<td>6,700</td>
<td>6,400</td>
<td>9,100</td>
<td>8,300</td>
<td>8,400</td>
<td>£7,000/mth/emp</td>
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<td>STV per man</td>
<td>5.59%</td>
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<td>-2.09%</td>
<td>1.49%</td>
<td>3.90%</td>
<td>3.93%</td>
<td>4.30%</td>
<td>4.30%</td>
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<td>Lead time reduction (Excl JSF) (No. of orders produced &lt; than lead time)</td>
<td>250 TBC</td>
<td></td>
<td>350</td>
<td>350</td>
<td>313</td>
<td>430</td>
<td>300</td>
<td>363</td>
<td>409</td>
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<td>Site variable charging rate (£)</td>
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<td>£49.85</td>
<td>£57.19</td>
<td>£47.50</td>
<td>£45.20</td>
<td>£48.20</td>
<td>£46.90</td>
<td>£47.70</td>
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<td>£49.03</td>
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<td>% External schedule adherence</td>
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<td>100%</td>
<td>100%</td>
<td>99%</td>
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<td>100%</td>
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<tr>
<td>AM Backlog reduction (Excluding JSF)</td>
<td>200</td>
<td></td>
<td>100</td>
<td>208</td>
<td>230</td>
<td>246</td>
<td>300</td>
<td>290</td>
<td>252</td>
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<tr>
<td>JSF in jig</td>
<td>N/A</td>
<td></td>
<td>100%</td>
<td>00000</td>
<td>1</td>
<td>0</td>
<td>%</td>
<td>25%</td>
<td>25%</td>
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<tr>
<td>External owings</td>
<td>33</td>
<td></td>
<td>18</td>
<td>22</td>
<td>28</td>
<td>33</td>
<td>24</td>
<td>28</td>
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<td>Successful new business bids</td>
<td>2</td>
<td></td>
<td>1</td>
<td>(value &gt; £5m)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>% design release to plan</td>
<td>N/A</td>
<td></td>
<td>100%</td>
<td>36%</td>
<td>48%</td>
<td>81%</td>
<td>84%</td>
<td>83%</td>
<td>85%</td>
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<td>Working time directive</td>
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<tr>
<td>PDR Completion</td>
<td>89.4</td>
<td></td>
<td>&gt;95%</td>
<td>2%</td>
<td>15%</td>
<td>91%</td>
<td>98.0%</td>
<td>97.0%</td>
<td>1.8%</td>
<td>13.4%</td>
<td>13%</td>
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<tr>
<td>10 % improvement in the employee opinion survey</td>
<td>33.50%</td>
<td></td>
<td>43.50%</td>
<td>33.5%</td>
<td>57.4%</td>
<td>57.4%</td>
<td>57.4%</td>
<td>57.4%</td>
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<tr>
<td>% attendance level</td>
<td>97%</td>
<td></td>
<td>&gt;97%</td>
<td>97.5%</td>
<td>97.8%</td>
<td>97.4%</td>
<td>97.6%</td>
<td>97.5%</td>
<td>97.2%</td>
<td>97.1%</td>
<td>97.1%</td>
<td></td>
<td></td>
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<tr>
<td>Chairman’s award nominations</td>
<td>462</td>
<td></td>
<td>400</td>
<td>0</td>
<td>10</td>
<td>17</td>
<td>27</td>
<td>259</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Resource plan % deviation from plan</td>
<td>N/A</td>
<td></td>
<td>&lt;5%</td>
<td>3.50%</td>
<td>4.99%</td>
<td>4.60%</td>
<td>4.89%</td>
<td>4.60%</td>
<td>4.28%</td>
<td>4.3%</td>
<td>4.3%</td>
<td></td>
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</tr>
</tbody>
</table>
10 Blue Sky transformation projects

Transformation Programme Leader
Frank Hayden

Implementation Planning
Brendan Hindle

EFFECTIVE ENGINEERING
Neil Graham

EFFECTIVE SUPPLY CHAIN
Chris Holt

EFFECTIVE MANUFACTURING
Pete Barrow

EFFECTIVE MAINTENANCE
Lance Zeall

EFFECTIVE PRODN PLANNING & LOGISTICS
Tracey Chambers

CULTURE CHANGE
Dave Wright

MODERN WORKING PRACTICES
Gill Turner

QUALITY MANAGEMENT
Steve Markham

FINANCIAL MANAGEMENT
Doug Garbutt

NEW BUSINESS
Nigel Blenkinsop
Short, high energy meetings focused on decision making. Using unedited run chart data, or well prepared A3 REPORTS. Team only meet together for 19 hours out of 200 per month (10% of time). All afternoons kept free of meetings for managers and team leaders to work on business improvement with their local teams.
Lean Learning Academy

Week One
- Lean tools and Lean Leadership behaviours

Week Two
- Go Look See
  - Establish current state

Week Three
- Prepare Future state
Value Stream Mapping

- Paint process improvement plan example
- Future state has less process steps, improved quality and productivity
Culture Change: Lean Learning Academy

LF + LC = LEAN

LF + NLC ≠ LEAN

NLF + LC = LEAN

NLF + NLC ≠ LEAN

Common Denominator = Lean Culture
Results so far.....

Progress since 2004

- 80% improvement in Typhoon outstanding work
- 117 transfers from Typhoon to F-35
- 51 reduction in Typhoon subcontractors
- Process Capability Vs Design Reqs
- “Design Factory” best practices
- F-35 Lightning II Design FMEAs
- New Business projects

- 59% reduction in Supplier concessions
- Improved Spec. Equipmt Quality & Delivery
- Typhoon Tranche 2 sourcing strategy
- F-35 Lightning II International Participation plan

- 19% productivity improvement
- Variability reduction projects - Hot Form - 60% reduction in backlog
- Typhoon Takt-Time Production
- F-35 Lightning II Production System Design
- 180 leaders completed the Lean Learning Academy

- 16% reduction in Typhoon & Operations Staff
- 11 transfers to RR Barnoldswick, 8 to Hurel
- Lean Logistics Partner strategy
- Effective meetings/ Standard Diaries
- OEE improvement plan

- Joint Mgmt & TU communications
- 45% reduction in accidents
- Joint Mgmt & TU Rate Adaptability team
- Absence from work <3.5%
- 22% improvement in Employee Opinion Survey scores

- 30% improvement in Scrap and Concessions
- F-35 Lightning II Parts Quality
- Inspection Process reform

- 2 Building transfer
- Airbus contracts extended to 2010
- 25% reduction in non-labour costs
- Pricing & Costing policy reform
- Typhoon Rudder & Flaperon insourced
## Production System evolution

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Production Build</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of Parts</strong></td>
<td>38,000</td>
<td></td>
<td>60% decrease</td>
</tr>
<tr>
<td><strong>Lead Time</strong></td>
<td>48 months</td>
<td></td>
<td>50% decrease</td>
</tr>
<tr>
<td><strong>Peak Build Rates</strong></td>
<td>9</td>
<td></td>
<td>100% increase</td>
</tr>
<tr>
<td><strong>No. of Manufacturing Processes</strong></td>
<td>130</td>
<td></td>
<td>25% decrease</td>
</tr>
<tr>
<td><strong>Man-Hour Content</strong></td>
<td>c60,000 hrs / aircraft</td>
<td></td>
<td>40% decrease</td>
</tr>
</tbody>
</table>

Compared to Tornado Baseline
Success Factors

Vision

“Best Airframe Design & Manufacturing business in the world”

– Zero accidents culture
– Year on year improvement in quality and productivity
– Highly skilled and motivated people
– Best supplier to Airbus
– Best performing partner on Typhoon
– Best performing teammate on F-35 Lightning II
– Winning new business
– Growing BAE Systems Market Value Added