SECORA

Case study: Operational Effectiveness Through SLIM (Lean) Implementation

The Laser Weld Operations of a High Tech Tier 1 Automotive Supplier to Mercedes Benz

Background

A Tier 1 European automotive supplier had major issues on a newly launched product:

- Failure to meet customer volume requirements
- Failure to meet customer quality requirements
- Massive cost overrun

Using the SLIM (Lean) Methodology Secora helped the client to solve its most prominent operational effectiveness issues and reduce internal manufacturing cost to below the original target costing, without capital investment or design change.

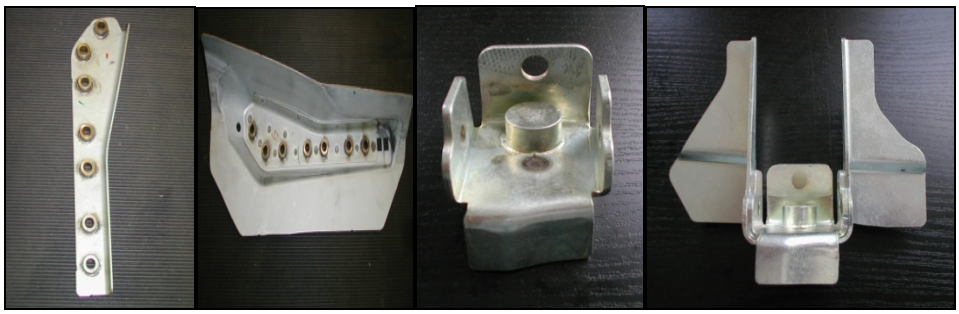

Fig: An example of the types of product manufactured by the automotive supplier. Note: Some parts are 'safety parts' and as such must be certified and the results documented.

Scope

The project scope initially focused on the laser weld and inspection part of the process, which was in the beginning the most significant bottleneck in the operation.

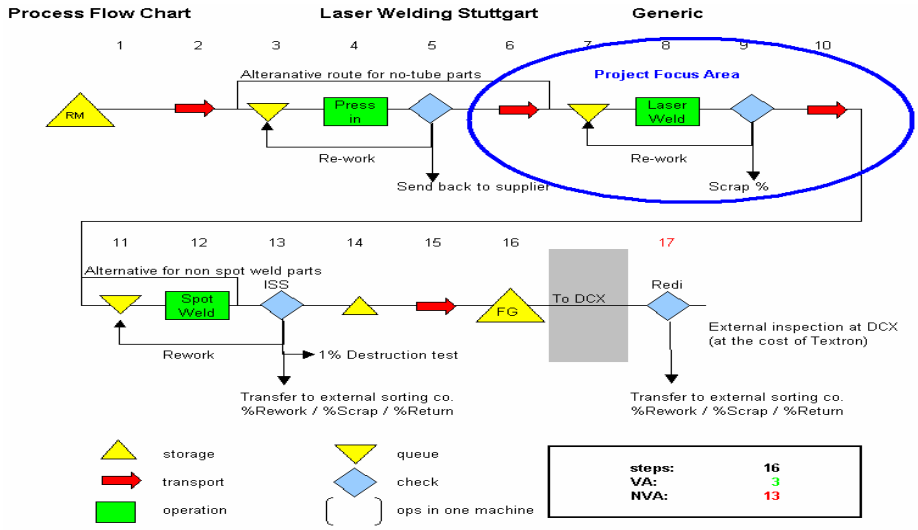

Fig: The high level process map showing a 16 step process however, only 3 process steps are value adding.

Due to the nature of the parts being manufactured three 100% visual and physical testing loops were in put in place after welding (blue diamonds above). These checking steps were a significant additional unplanned cost and greatly reduced throughput times.

Methodology

The SLIM (Secora Lean Implementation Methodology) was applied for this engagement, due to the nature of the issues and the necessity for rapid response and quick, yet robust, fixes for operational issues. The high performance nature of the parts (safety parts) meant that mistake proofing and risk mitigation had to be included in every optimization step.

The Lean tools principally used for this engagement were:

- Kaizen Workshops (Small Incremental Change – immediately Implemented)
- 8 wastes (Identification of the 8 types of waste)
- Value Stream Mapping
- Takt Time, Line Balancing & Heijunka (Load Smoothing)
- Quick Set-Up (SMED) & Poke Yoke (Mistake Proofing)
- 5S, Andon (Visual Management) & Gemba (Go See)
- Standardization (Standard Work, Standard Set-Up, Visual Inspection Standards)

The Lean tools were applied on both a Macro and a Micro level. Some examples of the improvements are shown below.

A chain of events during the production launch had put the manufacturing facility out of control. Due to the ever increasing requirement to supply parts and the fact that 21 shifts were already fully utilized there was very little time to make operational improvements. After detailed analysis and Value Stream Mapping the Secora Lean team started first at the weld station itself. The initial changes were programming changes after the positioning of the weld jigs was improved using SMED and Poke Yoke techniques.

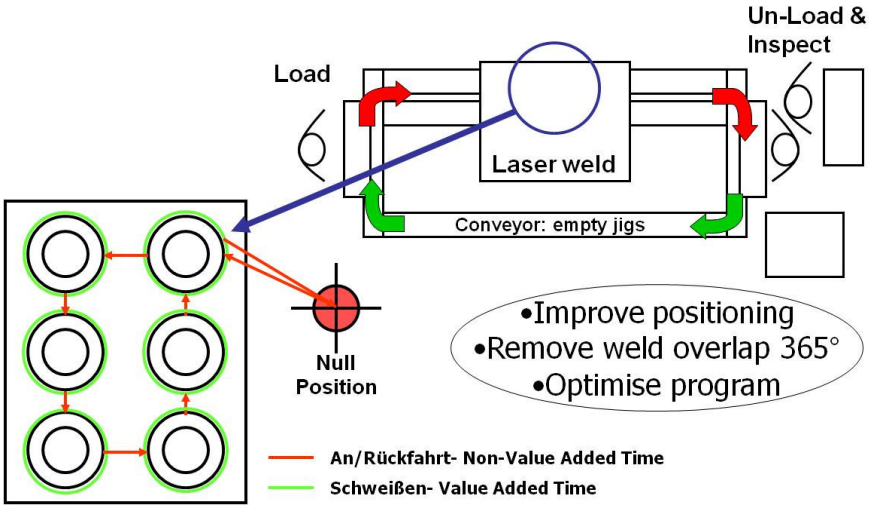

Fig: Optimizing the Laser Weld Programming using SLIM. The individual movements of the laser weld head were tracked and broken down into values added and non value added. In addition the overlap (factor of safety) was reduced so that the total weld rotation was 365 degrees and not 560 degrees.

Once the individual programs had been modified the welding jigs were optimized. The effect was once again to reduced the 'dead time' of the laser welding equipment. This meant too that the parts being welded could be correctly matched to the most efficient laser welding equipment, this increasing the OEE (Overall Equipment Efficiency).

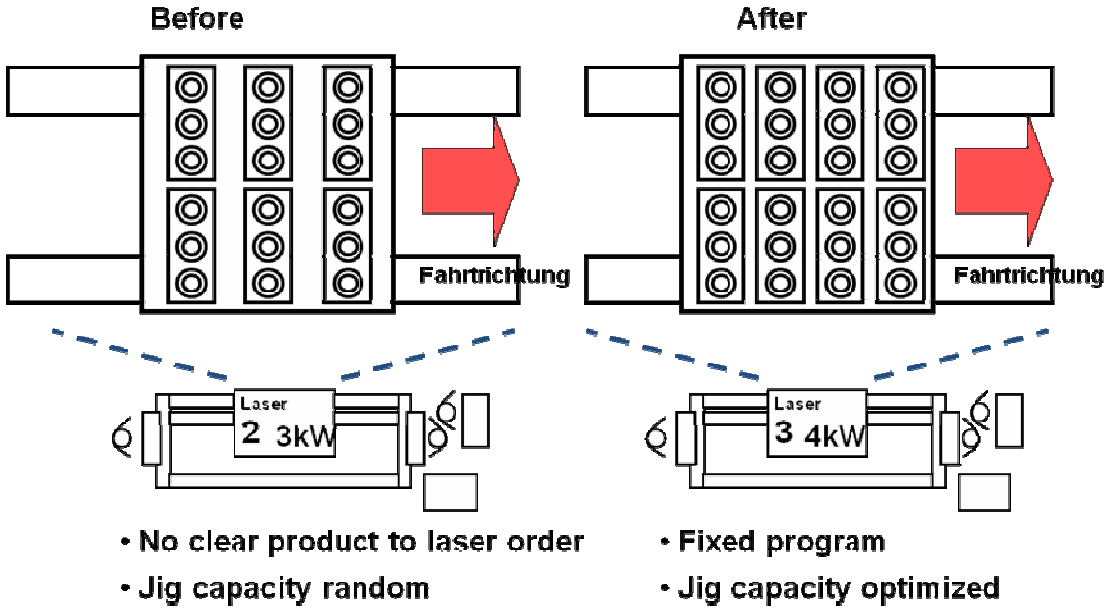

Fig: Optimizing the Laser Weld Jigs on the basis of removing as much of the 8 wastes as possible.

Whiteboards, paper and equipment were taken to the welding area and the following analysis generated (it has been prepared in digital format for this case study – normally all such work is left in a paper format in the workplace so that the Kaizen process can continue with the people in the workplace). It is a 'drill down' specifically around the set-up process. All sub-process steps are detailed as are the inputs and outputs of each process step. This is a thought provoking basis for the cause and effect analysis which follows.

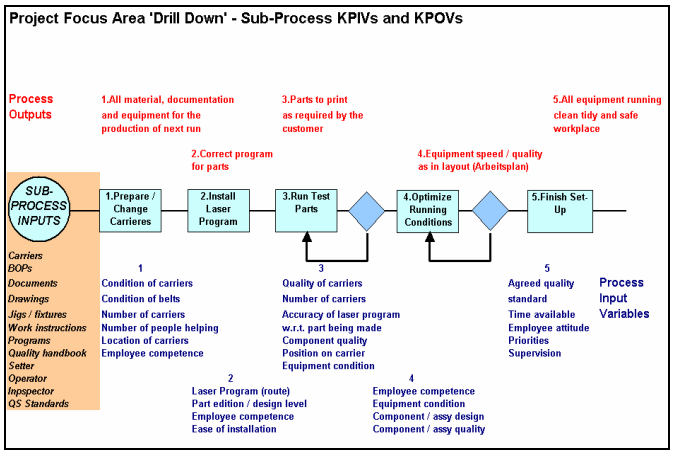

Fig: Drill down from the high level process map, showing explicit key details at a chosen focus area of the process.

Although the engagement was led and managed by Secora, the ideas and creativity came from the team that was actually running the process. Below is an example of a cause and effects analysis that was done with a group of laser weld operators and setters in a production area.

	Process Inputs / Process Outputs	1 Uptime	2 Tooling / Loading Cost	3 Good Parts Produced	4 Unplanned Scrap	5 Maintenance Cost	6 Process Support	7 Direct Labor Cost	8 Capacity	Total
1	Jig config. (capacity)	7	9	5	7	7	7	7	9	396
2	Condition of equipment	10	5	5	5	9	5	5	5	348
3	Line management	7	5	5	5	7	5	9	3	328
4	Jig ergonomics (loading)	5	7	5	9	1	9	7	5	322
5	Setting procedure	7	1	7	7	3	7	7	5	320
6	No setter cover	10	1	10	3	1	3	5	7	314
7	Laser program	5	7	7	9	1	9	3	5	310
8	Employee qualification	7	1	7	5	9	5	3	3	294
9	Employee motivation	7	1	5	5	9	5	7	1	292
10	Part geometry	5	7	5	9	1	9	3	5	290
11	Organisation	7	1	3	3	7	3	9	5	280
12	Component quality	5	1	7	9	1	9	5	1	268
13	Belt speed / Length	5	1	3	3	5	3	7	9	262
14	Laser power	1	1	10	5	3	5	1	9	260
15	Tube press quality	3	1	7	9	1	9	5	1	252
16	Manning ratios	7	1	3	3	1	3	7	5	222
17	Inspector qualification	3	1	3	9	1	9	5	1	212
18	Line balance	3	1	3	3	1	3	7	5	190
19	Part material	1	5	3	5	5	5	3	1	184
20	Inert gas cloud	1	5	3	5	3	5	3	1	170
21	Functional requirements	1	1	5	3	3	3	1	1	132
	Total	848	310	1060	944	532	354	864	602	

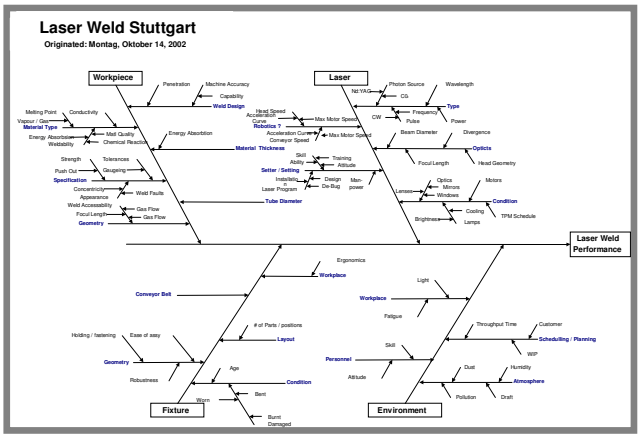

Fig: The Cause and Effects Matrix which sorts and prioritizes the information gained using the Ishikawa analysis and subsequent multi-voting

Once the laser throughput had been significantly increased the attention was turned to the other types of waste, in particular defects & transport (motion). The long weld times had meant that large buffers of jigs were required (WIP – Work In Progress) which were held by long conveyors before and after the weld station. In addition to the transport reduction process optimization and mistake proofing steps (e.g. remote weld temperature and laser focal point tracking) were implemented. These non destructive monitoring techniques meant that 'leading indicators' (process input variables) were being monitored rather than physically testing the parts after manufacturing to 'see if they break'.

Fig: Examples of the excessively long conveyors necessary to hold production buffer stock which compensates for poor productivity and Laser 3 before the POKE YOKE process monitoring (weld temperature & focal point/focal length) for leading indicators.

Project Findings & Improvements

The most effective way to demonstrate the power of the Secora Lean engagement is with a before and after comparison.

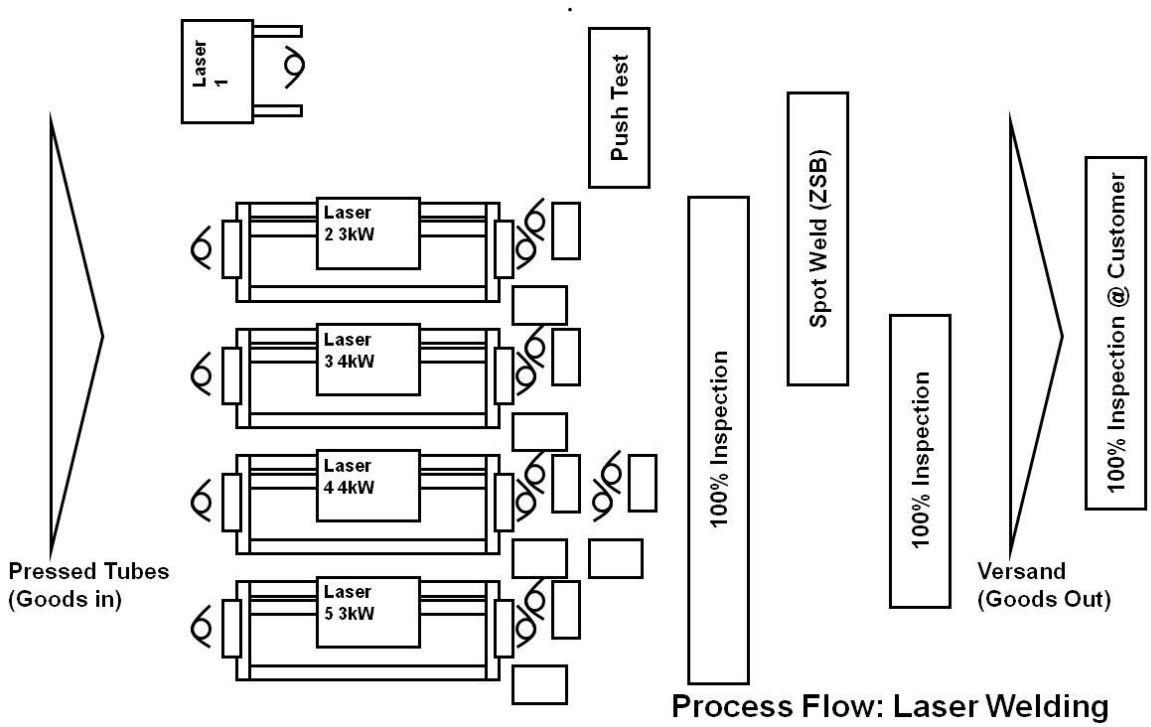

Fig: The original layout of laser weld operations in the manufacturing facility before the Secora engagement

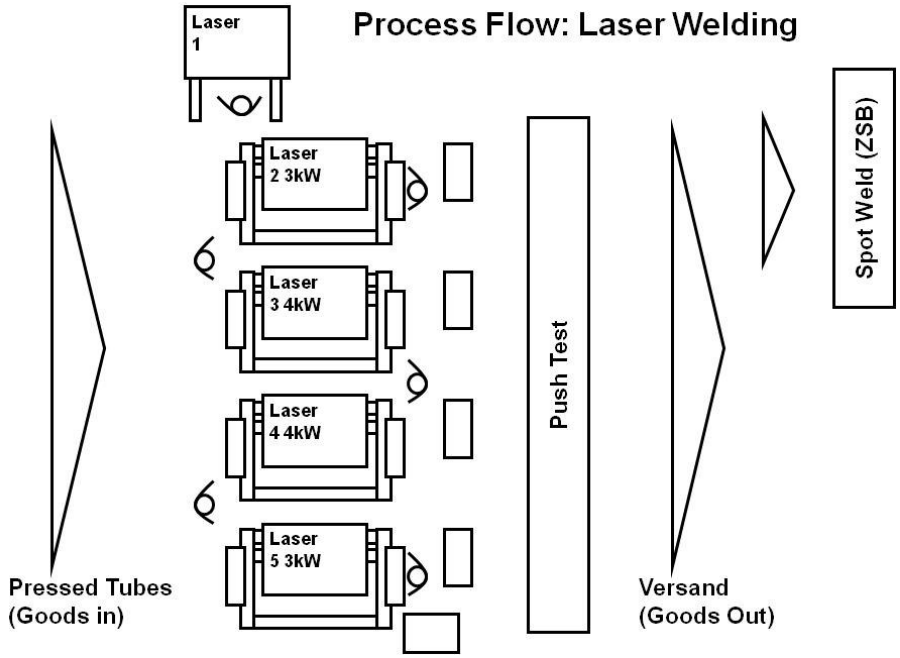

Fig: The final layout of laser weld operation in the manufacturing facility after the Secora engagement

Whilst the operational effectiveness was greatly improved using Lean (as shown above) the output and quality also improved. There were no 'trade-offs' or compromises made between speed and quality or cost and delivery as is often the case. The graph below shows how the throughput increased on a weekly basis up to the desired level of 45,000 parts per week which was just over 10% above the customer 'Takt'.

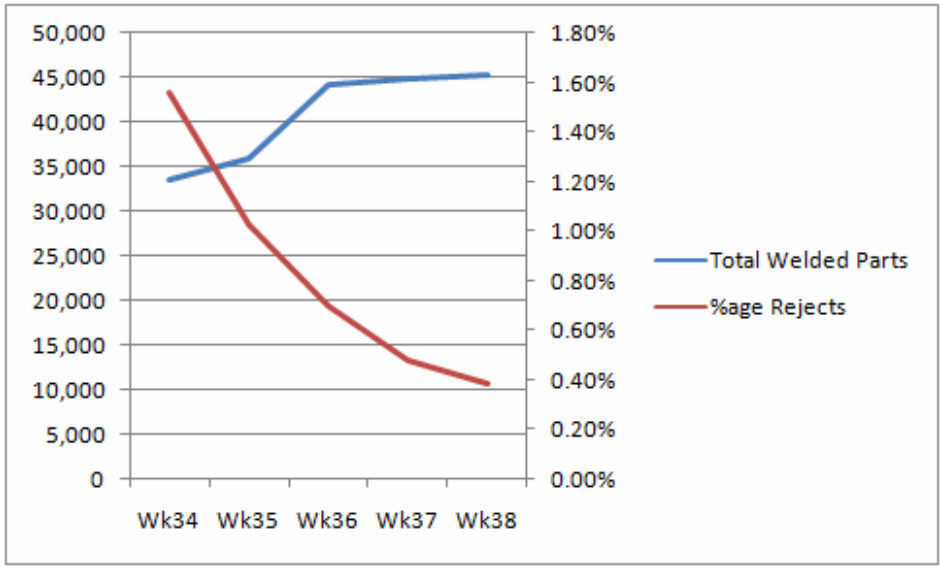

Fig: Graphical representation of the throughput and quality improvements made during the Secora engagement. Note that a percentage scrap rate is non-linear in absolute terms as volumes change

Outcome

Over a period of 3 months (including scoping & feasibility study) with a totally immersed 3 man senior team, the following improvements were made:

KPI	Before	After	Delta
FTEs (Laser Weld Dept)	61	24	-37
Weekly Output	33.6k	45.2k	11.6k
Parts Per Hour	210	376	166
Shifts / Week	20	15	5
Reject Rates	16000 ppm	4000 ppm	12 000 ppm
Transport (Motion)	207m	73m	-134m
Process Steps	16	4	-12

The improvements detailed above resulted in a **Total Net Annual Cost Saving of Euro 2.2M** !

In addition to the cost savings, quality improvements and optimized process capability all remaining employees received basic Lean training and a robust continuous improvement philosophy was institutionalized at the facility.