

Production Optimization of Automated Fastening Systems with Efficiency Software and Machine Remote Access in the Airframe Industry

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ABSTRACT

The demand of fulfilling increasing Prime Customer requirements forces Tier 1 suppliers to continually improve their system solutions. Typically, this will involve integration of "state of the art" tools to afford the Tier 1 supplier a throughput and cost advantage.

The subject "Production Optimization Approach" addresses the machine and process optimization of automated fastening machines in operation at customer factories.

The paper will describe and focus on the main aspects of production optimization of existing machines to meet and exceed the required customer production and reporting criteria. Furthermore, the paper will present existing examples based on use of the established diagnostic tools

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STRATEGIC ORIENTATION

In recent years, the Airframe shell and section manufacturer focused on the improvement of the machine's reliability and availability. Nowadays, the machines are reaching production availability rates between 96-98%.

Increasing aircraft rate delivery demands and cost pressures by the Prime Contractors force the Tier 1 suppliers to raise the production output without investing in new equipment. when small incremental rate increases occur.

Broetje-Automation has taken this opportunity to develop a method to investigate the complete production process from load to unload of the workpiece and by using the Software package trade named "**Soul** Optimization©". and being coupled to a remote service team directly connected to the machine control.

Using software, the customer is able to iteratively improve the processes on or around the machine to dramatically raise output without investing in additional equipment.

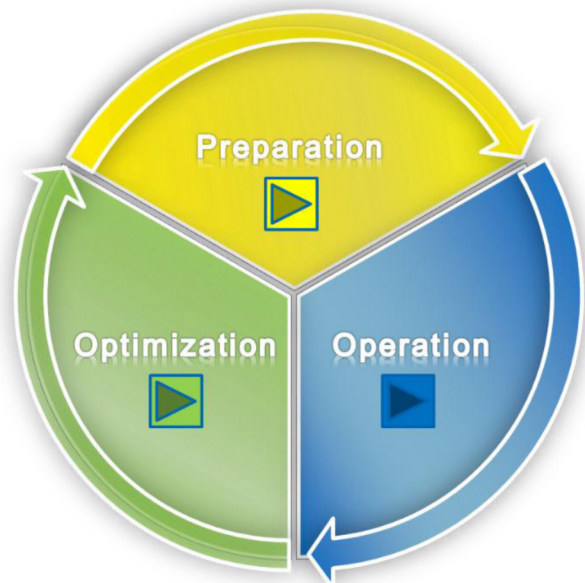


Figure 1. Optimization Process

THE SOFTWARE PACKAGE

The **Soul** Optimization Software is comprised of three components:

- **Efficiency Diagnostics**
 - Reports efficiency, availability, utilization of the machine
 - Detects the reasons for downtime
 - Enables countermeasures
- **Process Diagnostics**
 - Production progress report
 - Cycle time reports
 - Sensor diagnostic reports
 - Incomplete cycles report (identifies positions to be reworked)
 - NC program run-time reports
 - Fastener reports
- **Visualization**
 - 3D visualization of production data
 - Visualize the production status with one click
 - Visual production deviation reporting

PRINCIPLE METHOD

Each machine generates a significant quantity of control signals during the production fastening process, such as:

- Squeeze force
- Clamp force
- Drill speed
- Drill feed
- Head Height
- Etc.

the machine operating status

- Machine on / off
- NC Start / Stop
- Override
- Single block
- Automatic Mode
- Etc.

and failure information.

- Failure number Text
- Failure start time
- Failure end time (duration)
- Etc.

In Use, the software package is installed on the machine controller

- Automatically collects data from each machine component
- Machine status and its duration
- Reasons for downtime
- Evaluates and presents data in a meaningful format (tables and/or pie charts)

THE TASK

Using the results of the software the machine user is able to:

- Identify areas for improvement
- Highlight functions/processes to be optimized
- Performance monitoring
- Machine uptime monitoring
- Line throughput monitoring

Since the software is continually working in the background, the user is able to receive instant feedback on process changes.

REPORTS

The Software generates several reports based on the process data. In a first overview, the user is able to identify the true production time, the idle time and down time of the machines for a specific period.

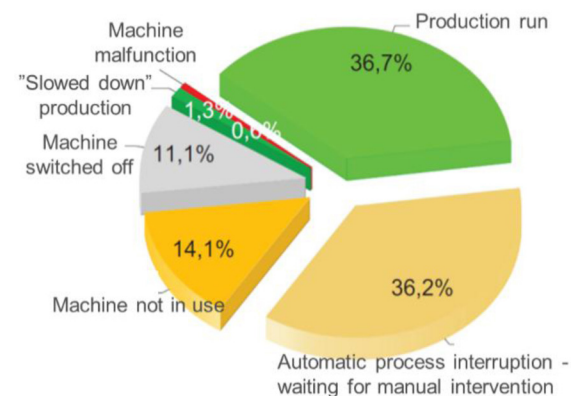


Figure 2. Machine Operating Diagram

The pie chart as shown in [Figure 2](#) indicates that the machine has lost 36.2% of the available production time because of delayed operator intervention. The machine was not in use for 14.1%, was switched off for 11.1% and was down for failure for 0.8%. Furthermore, the pie chart conveys that the override switch was reduced to <100% by the operator (Slowed down production).

Summarized in [Figure 3](#) below, the availability of the machine reaches 99.4%, but the machine was only productive 38% of the time. The question is "why?" and "what could be done to increase productivity?".