THE SECRET OF FASTER LAUNCHES – root cause software

It takes a seasoned and highly-skilled team to launch complex weldments. Isolating the parts or operations that are contributing to departures from nominal is a painstaking process. This whitepaper describes tools that streamline and accelerate the launch of complex weldments.

CURRENT BEST PRACTICE

First, let's look the way parts are launched now. The following 7 steps are typical:

1. Measure and review dimensional data of a few sample parts.
2. Agree on data interpretation
3. Make a best estimate of the root cause
4. Identify fix options.
5. Make adjustments and re-run the process.
6. Repeat steps 1 to 5 until the process seems to be in control and capable.
7. Manually create charts and graphs to document results for buyoff report.

The process can be streamlined if engineers know where the process must change to be in control, and what the limits of process capability are. Answers to these questions are obscured:

Data validation. This means measuring multiple sample parts and correlating it with CAD nominals. Achieving this can be very difficult.

Isolating root cause. Without valid data it is very difficult to determine if the process is in control, let alone the limits of its capability.

A NEW GENERATION OF ROOT CAUSE SOFTWARE

A new generation of root cause software addresses these issues.

LAUNCH STEP	ROOT CAUSE SOFTWARE IMPACT
Measure and validate data	The software streamlines part measurement, regardless of source – CMM, gage or scanner – and correlation with CAD nominals.
Isolate root cause	The results of fitting algorithms are displayed graphically Problem areas are visible at a glance. Engineers isolate features or parts that are not in control, i.e. root cause
Identify the fix options	The team applies its skills and experience as usual.
Simulate and choose	Simulation replaces physical iteration. Each simulation takes a few minutes. Knowing the process is in control and its capability engineers can be more aggressive.
Buyoff report	The software generates graphics and other data for buyoff reports.

Seven steps are reduced to four. Graphic displays convert reams of tabular data to salient engineering details taken can be grasped at a glance. Simulation in software replaces most of the iteration of actual parts and assemblies. It eliminates the effort of producing high impact graphics for reports. The tools leverage the skills and experience of engineers. The result is the best-quality and least-cost launch.

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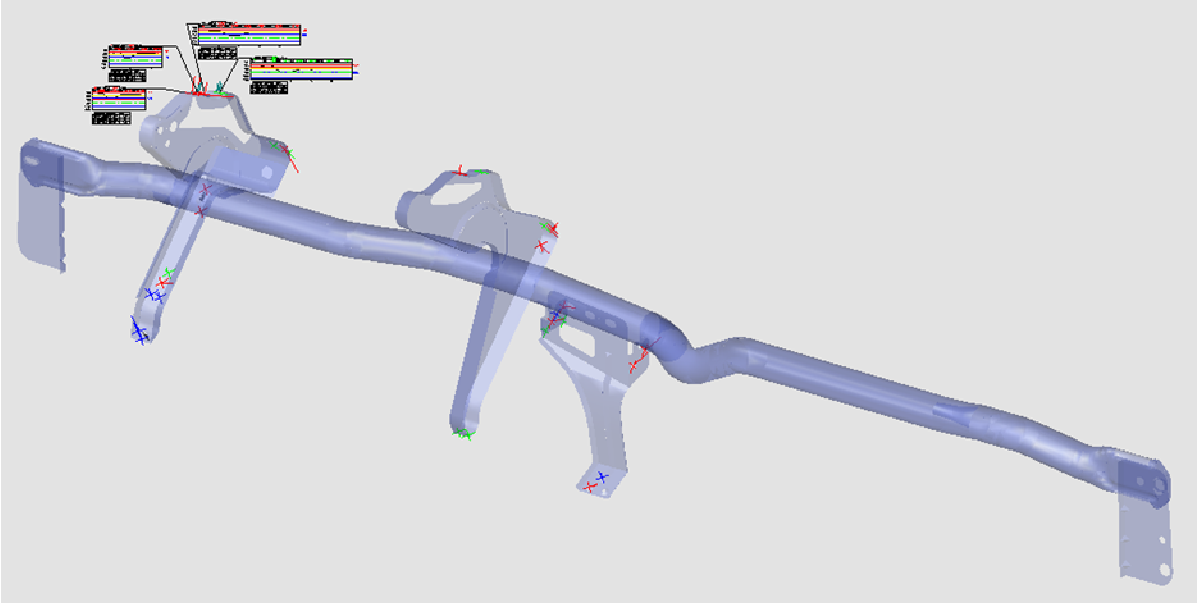
CASE STUDY

This example of a weldment in an auto maker assembly process applies to sub-assembly suppliers.

The problem.
During assembly the automaker discovered that the glovebox and steering component mounting locations on a cross-car support member were out of alignment. Plus, there were unacceptable gaps in the airbag opening area. The best fix process was further confused because the gaps around the airbag opening sometimes appeared at the top, sometimes at the bottom.

Data validation.
Tools in the software enabled the engineers to orient the cross-member on the CMM bed and measure the crossmember without creating a precision holding fixture. Other tools were used to bring in the original CAD files of each component and create the program for the CMM. All CMMs are supported, as well as scanners or gages. After running the program on the CMM the data was brought back into the root cause analysis software.

Isolating the root cause. The root cause software displayed graphic reports, in whisker, label and statistical balloon form, that highlighted the deviations from nominal. Sample below:



Statistical labels showed two distinct processes. The engineers used the software to drill deeper and determine that the parts from each assembly line were repeatable to themselves but not to parts from the other assembly line. Since the reports also showed a high percentage of measured features were out of tolerance more detailed analysis was required to identify the root cause.

Using the fitting tools in the software the data from the crossmember measurements was optimized and compared with the CAD nominals. Tools in the software enabled engineers to isolate each part from the overall assembly. The whisker data showed at a glance that each subassembly was within tolerance, confirming the reports from the supplier.

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So, engineers could focus on the crossmember bar itself. The analysis showed that the angle bracket at one end was welded on a skewed orientation. And, that the locator holes on the bar were off by 3mm. These factors made the crossmember difficult for operators to locate the bar consistently on the assembly fixture. The instability in this operation caused the two distinct groups of results that were shown in the initial data analysis.

Determining the fix.
The engineers used the root cause software to simulate the effects of repositioning the mounting holes. The engineers identified mounting hole positions, within process capability limits, that would drive the entire assembly to nominal. Unproductive re-work of component parts was avoided. Engineers used the analysis and fitting tools in the root cause software to determine where the process was not in control, and simulate how to change it within the limits of capability.

Buyoff.
The root cause analysis software generated supporting graphics to win buyoff for this solution. No re-measurement of parts or the completed assembly was required. Nor were there any iterations of actual parts