

Multi-industry

Waltonen Engineering

Upfront virtual processes improve quality and reduce cost

Product

Tecnomatix

Business challenges

Understand the impact and cost of poor dimensional quality

Define optimal product and manufacturing strategies

Effectively capture and manage knowledge for repeat use

Collaborate effectively across company and supply base

Keys to success

Structured process for addressing dimensional accuracy before production – Variation Analysis, part of Tecnomatix software

Results

Dimensional-related costs reduced by 20 percent to 50 percent

Avoidance and elimination of significant design and production costs

Significantly reduced hours needed to launch product

Specifications within tolerance the first time

Waltonen Engineering uses Tecnomatix to help manufacturers predict dimensional quality issues, avoid significant production problems and maximize profitability

A structured approach to improving quality

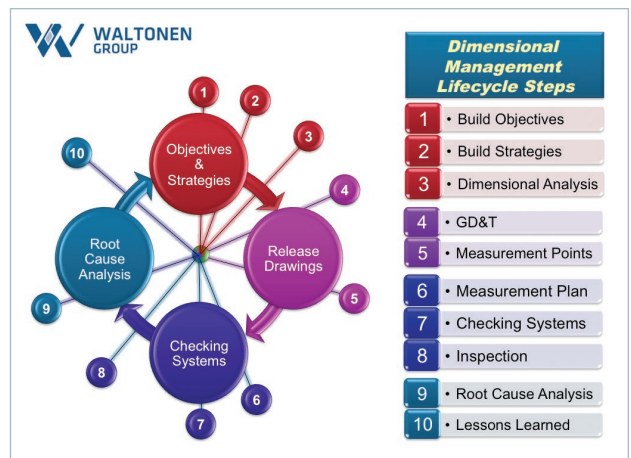
Waltonen Engineering, a privately held company incorporated in 1957 in Warren, Michigan, United States, provides full-service design and engineering, manufacturing systems, quality engineering, software solutions and professional resources to a broad range of customers across multiple industries.

At a time when companies are looking more than ever to reduce cost, increase efficiency and find a competitive niche, Waltonen Engineering brings a unique advantage, a structured focus on improving quality and reducing cost through the implementation of a dimensional management process. “Typically, as part of their efforts to reduce cost, companies focus on consolidating manufacturing facilities, outsourcing globally, merging work forces and going green,” says Bryan Novach, vice president, Waltonen Engineering. “In addition, they look to the supply base for cost reductions, optimization of manufacturing throughput and redesign of products for

more efficient use of materials. Moreover, while each of these can be effective cost saving initiatives, based on my 25 years of experience in the industry, I have learned that most companies are not really considering – and in many cases not really aware of – one of their biggest opportunities: dimensional quality, where the cost of poor execution can be substantial.”

Four categories that substantially impact costs

According to Novach, poor dimensional quality management results in four categories of substantial costs that could be greatly reduced by using a dimensional management process and Siemens’ Tecnomatix® software: 1) The cost of poor dimensional quality in products, 2) the cost of communicating and collaborating quality information, 3) the cost of not



Results (continued)

On-time, high-quality deliverables per quote

Ongoing knowledge capture and leveraging

Improved ROI for customers

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Vice President
Waltonen Engineering

capitalizing on the company’s quality knowledge base, and 4) the cost of producing quality information and training.

Novach cites that it is common across industries to have a lack of properly defined dimensional requirements and a lack of validation of those requirements early in the product development cycle. This greatly increases the opportunity for product inaccuracies or poor dimensional quality. “Even minor inaccuracies can cause significant problems, including start-up delays, production slowdowns, shut downs, overtime, travel, tooling changes, rework, excessive scrap, engineering changes after production release, product recalls, safety recalls and lawsuits,” says Novach. “Think about all the things that can go wrong and if we do not focus on these upfront, they can become excessive costs at production.”

Novach says the second cost associated with ineffective dimensional quality control can be found in lack of ownership, deficient communications, poor collaboration and the inability to access the appropriate database. Novach asks, “Who owns dimensional quality from the beginning to the end?” He notes, “Typically, most companies do not have one person or group responsible and therefore things get thrown over the wall until finally, the plant has to start some level of production. This is where all of the dimensional quality problems become real. This is also one of the most costly times to take corrective action. Most companies do not know or

have direct access to their dimensional capabilities; they do not have a central database that contains measurement data defining what they and their supply base are truly capable of. Typically when problems arise, to solve them, additional trips to suppliers, revisits to plants, additional meetings and special requests for measurement data are required, which all equals valuable time lost searching for quality information.”

The cost of poor dimensional quality management is often overlooked. Novach explains, “It’s interesting that companies can tell you exactly how much money was spent on electricity for each area of their operations, they can tell how much they spent on raw materials, new capital equipment and landscaping but they cannot tell you exactly how much they spent on dimensional quality issues. Those costs can be huge and they are always there. How much money could be saved if there was just a 20 to 30 percent reduction in expenditures due to the cost of poor dimensional quality?”

“Another cost of poor dimensional quality,” states Novach, “results from the inability to capitalize on company knowledge.” He explains, “Failure to leverage one’s own expertise often causes overspecified and unrealistic tolerances, re-use of poor design and manufacturing concepts, lack of common processes, constant re-analysis of products and procedures, and failure to effectively document and readily leverage feedback from lessons learned. Companies

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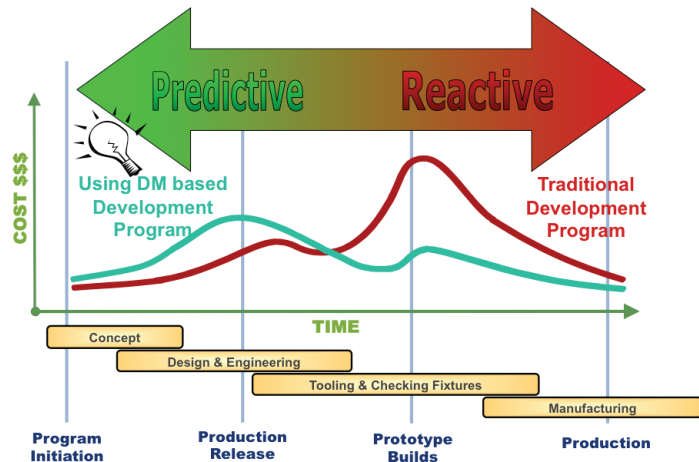
Lloyd Brown
President and Owner
Waltonen Engineering

continue to make the same mistakes over and over again. There should be a repository of best practices and lessons-learned based on quality and cost. People could then go to and retrieve data that supports key decisions.”

A fourth area to consider is the cost of producing quality information and training. Companies spend millions on producing the dimensional quality information required to release a product for production, get quotes from suppliers and problem solve. This area includes quality documentation, geometric dimensioning and tolerancing, measurement plans, coordinate measuring machine (CMM) programming, measurement equipment, auditors and supplier quality teams. Novach notes that companies seem to be doing a lot of the tasks associated with dimensional quality the old way and not leveraging the advantages of today’s technologies.

Baseline tools in place

Product lifecycle management (PLM) technologies to support product development cycle validation and optimization have come a long way. “The majority of companies have many of these technologies in place and they are taking advantage of them for many different digital validation projects, yet few companies are effectively leveraging these digital resources to optimize or to reduce the cost of dimensional quality,” says Novach. “When it comes to determining how things fit together at the assembly and subassembly levels, many companies still wait until some initial build event to flesh out the problems. They do not have a structured approach or the dimensional tools in place to analyze and optimize variation upfront in the product development cycle, where cost avoidance is critical. Some companies do some basic hand stack tolerance analysis, however this approach is usually not 100 percent accurate and is used more as a problem-solving tool, not early on as a preventative tool. It’s amazing to me to see how many companies have advanced analysis and 3D



CAD modeling technology in their design and engineering environments but still do tolerance stacks by hand. We wouldn’t consider doing our finite element analysis, thermal analysis or dynamics analysis by hand, would we? Yet, the engineering management processes at most companies do not include the information to implement a structured approach to define dimensional requirements, analyze and optimize the variation upfront in the product development cycle, where cost avoidance is essential.”

Novach says that many companies try to address the high cost of dimensional quality by getting some geometric dimensioning and tolerancing (GD&T) training, implement hand stacks (typically manually and quite ineffective), invest in metrology, perhaps even heavily and implement quality improvement processes, although usually reactive. He notes, “While these are important, if not implemented in conjunction with some type of structured dimensional management process, they can and often do ultimately increase costs, and certainly do not characteristically deliver the type of substantial savings that are possible. They are often reactionary, post mortem fixes to problems that should have been addressed early in the product development cycle. Companies need to shift the focus and provide training that will allow engineering and designers to

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Based on results from the Tecnomatix tool set, the specialty vehicle frame manufacturer was able to identify “variational hotspots,” receive recommended modifications and validate that the hotspots were eliminated – all virtually.

address dimensional quality early in the product development cycle.”

Lloyd Brown, president and owner of Waltonen Engineering, points out, “The earlier that dimensional quality issues are identified and corrected, the greater the savings. It is estimated that more than two-thirds of the ability to control costs is locked in when the design freeze occurs. For example, take a simple feature such as a hole size. Imagine its negative impact on profitability when that hole size must be changed when it gets to hard tooling versus in CAD.”

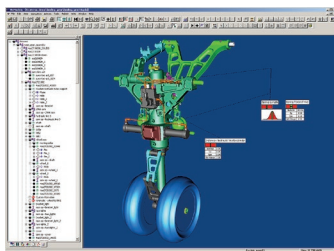
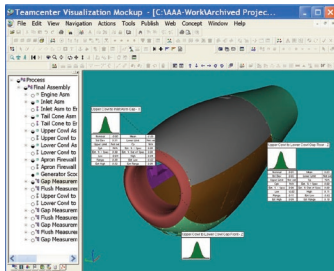
Reducing startup costs significantly through upfront dimensional quality management

For example, take a basic design feature such as a fastening, locating or gaging hole. Imagine its negative impact on profitability when it has to be changed after physical manufacturing equipment has been completed versus using CAD. Identifying the hole-size issue in CAD means only the digital model needs to be changed, which can often be done in minutes. Imagine the impact if this happens

on just five percent of the hundreds of design features most systems unusually possess.

“A structured dimensional management process is critical,” says Novach, asking rhetorically, “What if companies focused on dimensional quality early in the product development cycle? What if companies optimized the design and manufacturing process by building reliable virtual assemblies early in the concept and development phases? What if these virtual assemblies along with a dimensional management process improved dimensional quality at production startups? Moreover, what if such actions reduced manufacturing start up costs by 20 to 50 percent as related to dimensional issues?”

Novach knows the answer quite well as it has resulted in significant business for his company. Waltonen Engineering uses the Tecnomatix Variation Analysis solution to help deliver outstanding cost savings for the customers it serves. The Tecnomatix suite of tools provides CAD-embedded and CAD-neutral variation analysis and quality feature definition, CAD-embedded CMM



offline programming and inspection, and production analysis and reporting. This information proves invaluable in comparing production processes and plants, facilitating process stability, and summarizing process performance over time. Most importantly, these tools are enabling Waltonen Engineering to help its customers fix problems before they adversely affect product quality, operational productivity and overall profitability.

“When” matters

Novach points to the conflicting outcomes a company can expect as a result of “when” dimensional quality issues are addressed. The following example (Opportunity lost) illustrates the ill effects of tackling dimensional quality late in the design process. The next example (Opportunity gained) demonstrates the high value of applying tools from the Tecnomatix suite, including its powerful variational analysis (VSA) capabilities, from the start.

Opportunity lost

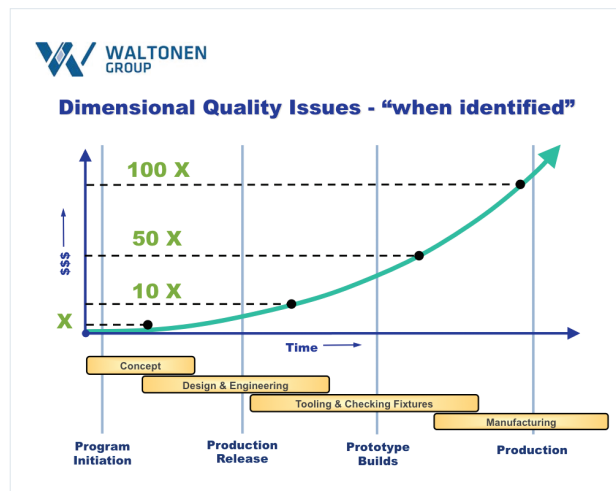
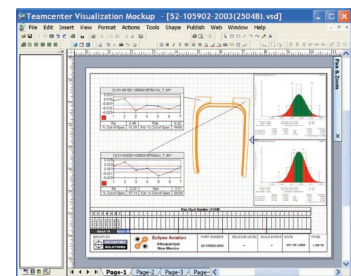
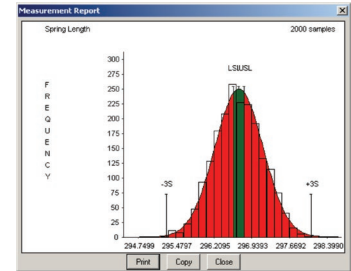
One manufacturer was running into production problems and delays and needed to significantly increase the rate of production to meet profitability targets. The impact of dimensional issues discovered in the build stage drove the manufacturer to seek Waltonen Engineering’s expertise in managing in-process variation. Working within the Waltonen Engineering framework, it was determined that more than 10,000 engineering changes occurred in the first calendar year of production. With 40 to 45 percent of them directly related to dimensional issues and variation, it was clear that many could have been addressed in the design stage, which would have significantly reduced delays and cost overruns in production. Among the problems identified, dimensional fits were greatly impacting production rate and scrap.

In addition, Waltonen Engineering’s staff found that the original dimensional requirements were not defined and documented and the build strategies were

introducing excessive variation, causing significant rework. Because of a lack of a structured methodology for problem solving and root-cause analysis, the manufacturer was overwhelmed with a lack of dedicated measurement devices for data collection. In one example, major rework – meaning system-level changes – was needed for a door system that was not mating properly with the fuselage. This impacted tooling and the supply base, which resulted in hundreds of thousands of dollars (US) in redesign time, travel and so on. While Waltonen Engineering was able to make recommendations to correct these issues, the manufacturer realized that much of the opportunity to increase profitability had already passed by.

Opportunity gained

In another example, a specialty vehicle frame manufacturer addressed all design issues upfront. With Waltonen Engineering’s assistance, the company established a manufacturing process and detail component part capabilities baseline. Tecnomatix Variation Analysis was employed to evaluate product design and establish a manufacturing process baseline and detail component part capability baseline. Using Tecnomatix, a 3D digital prototype – as small as a pacemaker or as large as container ship – is created to simulate the production build process. The



Solutions/Services

Tecnomatix

www.siemens.com/tecnomatix

Customer's primary business

Founded in 1957, Waltonen Engineering provides full-service engineering and design services, turnkey automated systems, system integration and personnel resource services. ISO 9001-certified, offerings include engineering and design services for product development, manufacturing processes and equipment.

www.waltonen.com

Customer location

Warren, Michigan
United States

"We play a key role in helping companies substantially reduce costs and eliminate a host of potential and likely problems, including missing schedules, doing unnecessary rework, generating excessive scrap, and failing to comply with regulations and code requirements. Tecnomatix dimensional quality tools are essential to our success."

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The result was an improved design within the subsystems and elimination of potential build issues prior to tooling investment.

digital prototype includes a comprehensive representation of geometry, product variation (tolerances), assembly process variation (sequence, assembly attachment definition and tooling) and measurements. The model is used to predict whether there will be any assembly build problems – before any physical parts are made, fixtures are developed or tooling is cut. It also identifies the root causes of the build problems and enables the design, tolerances and assembly process to be optimized very early in the product development process.

Based on results from the Tecnomatix tool set, the specialty vehicle frame manufacturer was able to identify "variational hotspots," receive recommended modifications and validate that the hotspots were eliminated – all virtually. The result was an improved design within the subsystems and elimination of potential build issues prior to tooling investment. In addition, this meant a defined datum structure and defined manufacturing process prior to the

start of tooling design, and the establishment of a baseline system capability prior to the start of actual production.

Measured success

"Ultimately, production automation has an enemy, and it's variation," says Novach. "Without upfront digital analysis of dimensional quality, companies put themselves in a reactive mode. At Waltonen Engineering, we show companies how to gain a cost advantage and a competitive edge by being in a predictive mode." Brown adds, "We play a key role in helping companies substantially reduce costs and eliminate a host of potential and likely problems, including missing schedules, doing unnecessary rework, generating excessive scrap, and failing to comply with regulations and code requirements. Our successes are measured. Tecnomatix dimensional quality tools are essential to our success."

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