



VEXTEC Corporation Business Overview

VEXTEC technology is a virtual “excellence engine,” that generates the information manufacturers need to make their products better.

For all its automation and process improvements, product development largely remains a process of trial-and-error. Factory automation has increased the number of widgets produced per minute, but provides no clues as to how many will be recalled. Manufacturers have replaced their drafting tables with computer-aided design, and used procedures like Six-Sigma to improve production processes, but they still don't know very much about the reliability of the products in the field. So they basically pretend to know. They produce a new design, run it through a handful of physical tests to make sure it isn't a complete disaster, then release it to the consumer and let the marketplace do the debugging for them. They repeat this cycle with version after version until they get it right, or until they've destroyed so much brand value they have to come out with a “new and improved” product, at which time, they start the process all over again.

Now certain sectors, in particular, safety critical products like aircraft parts and medical equipment, entail more physical testing, which inevitably increases time to market along with product costs. Over-engineering is certainly an alternative here. However, that approach typically uses more natural resources, adds weight and bulk, drives up costs even more, and thus results in loss of strategic advantage to low cost competitors. It's expensive in the long run, too. In aircraft engines, for example, every extra pound of weight results in between \$5 and 10 million a year in added fuel costs. Hardly in line with the new push for green technologies. Competitive pressures are even worse in the markets for general consumer products which mandate very short time to market, minimal physical testing and therefore shorter product life expectations – counter to everything proposed by “green” movement mandates for operational efficiency and minimal stockpiling of waste.

In the end, the trial-and-error approach amounts to little more than guesswork – even gambling – and has cost manufacturers' their reputations, and countless billions in market-share and shareholder value. Premature product failures in the U.S. alone cost \$40 billion annually in warranty-based payments, with the auto industry accounting for about 20% of that. Today's economic conditions – the unavailability of working capital, and the financial fragility of even the largest companies – has heightened the industry's need for a better way.



How do manufacturers get enough information about what they're making to make better products?

As customers use a product – drive it, fly it, expose it to weather conditions, etc. – they are actually imposing stress on the product. Over the past 20 years, manufacturers have developed the capability to analyze this stress using advanced computational analysis (FEA primarily) that is now readily available from numerous sources. But unfortunately that only really tells what happened to the product, not what's *going* to happen.

Before VEXTEC, there really was no computational framework robust enough to manage all the various levels of complexity required to accurately predict manufactured fleet reliability. Any prediction that was done, even the most advanced Ph.D. level or statistical analysis, was simply conjecture dressed up as fact. But that was the best anyone could do.

VEXTEC's Virtual Life Management™ (VLM) technology is the first to account for the fact that any manufactured product is made up of various interconnected materials reacting differently to the ever-changing levels of stress, over time.

At the microstructural level, every product consists of thousands, millions, or even billions of particles called grains. These grains are arranged in complex patterns during the product's manufacture. As the stresses of product usage are transformed into energy – through vibration, torque, heat, cold, and myriad combinations of the same – the damage is absorbed all the way down to the individual grains in the microstructure. These individual grains deteriorate over time and when enough damage has occurred to enough grains, the microstructure weakens and the product breaks.

Some consideration of the computational complexity involved puts VEXTEC's innovation in perspective. Modern day manufacturing is imperfect; products coming off the most sophisticated assembly line in the world are still as individual as fingerprints, so much so that no two are exactly the same. Therefore, the microstructural grain arrangements for *every single product* in a manufactured fleet of say, 500,000 units, are all different. If each individual product consists of 1 million grains – one would have to conduct 500,000 multiplied by 1 million grain simulations to accurately represent a 500,000 unit manufactured fleet. This would be an impossible task for even the largest internal engineering organizations to perform manually, or through physical testing in any affordable timeframe. Yet VEXTEC achieves this in its Virtual Life Management (VLM) computational framework in less than 30 minutes processing time using a standard PC. No other company in the world can do this.



VLM processing is so efficient we can create hundreds of fleet level simulations to zone in on the real matrix of possible answers that includes the universe of different possible client usage conditions, all the possible production variations, and all the possible economic impacts like raw material price fluctuations, and even contract warranty term adjustments. In short, all the information company management needs to make what they're making better, but could never get before. And we can do it all virtually, before the first product is ever built.

How much more valuable would a business be if it could solve product problems before they became problems?

What this means is VEXTEC has the capability to change the way products go to market, in every market from airplanes, to medical devices, to heavy machinery, to automobiles.

If a manufacturer could know precisely how a newly designed fleet was going to behave two, five, even 10 years into the future—BEFORE the first unit ever rolled off the assembly line—it would be the financial equivalent of owning a copy of next year's Wall Street Journal. For instance, consider the advantage a US automaker would have if they never had to face another surprise product recall. Their brand reputation would be superior to all others. Rather than budgeting millions of dollars into SEC required warranty reserve accounts, that money could be put to use on future product enhancements, green technology improvements for operational efficiencies, etc. Rather than talking about plant closures, they would be talking about plant expansions and hiring.

What kinds of innovations would companies be capable of if they could get to the best possible solution – and KNOW it was the best – faster?

The airline industry is under tremendous pressure to reduce costs while maintaining high safety standards. Yet the industry could save tens of millions buying 3rd party manufactured parts, or just repairing parts instead of continuing to buy high priced OEM replacements. More than 90% of the FAA certified replacement parts, tens of thousands of them in every airline fleet, are purchased from the original engine and airframe manufacturers. Yet hundreds of low cost alternative parts suppliers have been FAA certified as having equally capable parts. VEXTEC has worked with both types of manufacturers as well as with FAA certification representatives, and is now being used to substantiate that 3rd party manufactured parts are equally as durable in the long term. With this validation, it's only a matter of time before airlines change their spare parts practices to take advantage of the substantial savings.



VEXTEC's VLM was also just recently used to satisfy FAA repair certification requirements, showing that no difference exists between an original OEM turbine blade and a weld-repaired blade. At least one and possibly two airlines plan to start using these repaired blades in their engine fleets at a huge annual cost savings over OEM replacement parts. Our VLM simulations also provided far more insight into the FAA mandated process review than is typically achieved through the traditionally required – and six times longer – physical testing.

What would manufacturers build if they knew they could make their products as reliable and as efficient as they could be?

Several large diesel engine manufacturers have engaged VEXTEC to help them prepare for future EPA-mandated “greener” emission requirements. These engines, operating at higher internal pressure, produce less exhaust gas. However, these operating conditions are not easily achieved without causing severe levels of stress internally. Some VEXTEC customers have been conducting VLM simulations to tell the product line managers what their current engine system limits are. For others, VLM has been used to conduct virtual material change-outs before the designs are actually taken into development. Using VLM, VEXTEC can simulate the manufacture of 1000s of engine units, each with a range of new material formulations, all for the cost of a single physical engine test.

What would companies build if they knew they could not fail?

In a 2007 special report on innovation, The Economist cited the spread of information technology beyond the Internet and into older industries such as steel, automotive and aerospace as one of two powerful forces driving innovation (globalization was the other). VEXTEC's approach to creating product excellence is one such example of applying information technology to spur innovation in old-line industries. With computer cycles so much cheaper than physical testing cycles, VEXTEC promises manufacturing companies in the aerospace, industrial equipment, automotive and medical industries a whole new level of insight about their products and how to make them better. For the first time, manufacturers no longer have to be restrained by the time-worn economics of trial-and-error product development, and make-it-and-break-it product testing. Forward-thinking companies are discovering VEXTEC's VLM technology can show them how to improve every aspect of their products – reliability, performance, overall quality, and lifetime cost – before those products are ever built. And that this information has the power to make their entire business better.



About the company.

Since its inception in 2000, VEXTEC has self-funded and been the recipient of grants from various branches of the U.S. Defense Department. In the process, the company has been deemed “in the national interest,” and honored as a U.S. Army Top 25 Strategic Investment.

In 2008, VEXTEC began offering VLM as a managed service to select companies in the industrial equipment, aircraft, automotive, and medical device industries. These engagements have resulted in a variety of new product development, warranty, cost reduction and green technology- oriented strategic projects. The roadmap for VLM calls for the technology to be released as a software product that manufacturers will use themselves in the next 2-3 years. An aggressive sales ramp that will expand its applications and its reach into key markets is also in the company’s plans.

Contact info:

Frank Priscaro
Vice President, Marketing
VEXTEC Corporation
fpriscaro@vextec.com
c 408.921.3110

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