



VEXTEC Q&A

VEXTEC is located in Brentwood, Tennessee, a suburb of Nashville. The company was founded in 2000. The company has developed the ability to simulate and predict, with a very high degree of accuracy, the behavior of individual components and the life expectancy of entire systems made up of those components. To accomplish this, the company utilizes information about how materials behave at the microstructure level. VEXTEC calls this capability Virtual Life Management™. The company is already providing government agencies and manufacturing companies in the automotive, heavy industry, medical, and aerospace markets with accurate, invaluable information about the behavior and life expectancy of their components, systems, product lots and fleets.

Q. VEXTEC's Virtual Life Management™ (VLM) can be applied to both existing products and development stage products. For the latter, Virtual Life Management™ does not have access to broken parts or product failure information. Does this mean Virtual Life Management™ is inherently less accurate at predicting failure mechanisms when it is utilized at the product development stage?

A. On the contrary, VLM brings insight and accuracy to the traditional product development cycle, which is largely based on trial-and-error, and riddled with inaccuracies. The true value of VLM lies not necessarily in producing “the answer” for a new product that has never been built before (although we can drastically shorten the development cycle and point development teams in the right direction that much sooner). The value is in forecasting a complete matrix of answers based on all the variables that exist in real life. For example, VEXTEC is working with a manufacturer that is considering two different materials and three different surface coatings to prevent erosion and corrosion inside an engine block. This product has never actually been built, but we are providing durability insights for all 6 combinations and each failure mechanism under realistic customer applications. Even if this manufacturer could afford the cost, they could not afford the time to build all the prototypes, and then test and analyze all those combinations under realistic conditions. But VEXTEC can – using simulation. We have our own proprietary library of materials (which contains approximately 80% of known materials and alloys), and typically it's a matter of tailoring what's already in our library to match the material the manufacturer intends to build. Our value also extends to the manufacturing process, because we already know what kind of variability exists in manufacturing, and when we simulate it, we can specify just how sensitive the processing tolerances need to be in order to produce the desired results. When the component is finally prototyped, we can very quickly refine our analysis based on the actual part,



thereby eliminating the guesswork and associated risk inherent in the process of creating something new.

Q. In the product development world, is Virtual Life Management™ replacing an existing modeling system?

A. What we're replacing is a total reliance on the traditional, trial-and-error, make-it-to-break-it development mentality. Physical testing can be valuable; we often use it ourselves to supplement our data, but it's too expensive, time-consuming and inconclusive to use by itself. Computer cycles are far shorter than business cycles; we can produce accurate answers in weeks, not years. Manufacturers also only get answers from the tests they conducted, not from the tests they didn't have the time or money to run. But VEXTEC can simulate a whole range of test conditions to cover every conceivable condition. Instead of expending huge sums of money on a statistically insignificant number of physical tests whose results, by definition, don't mean much, adding VLM simulation can give manufacturers the results they really need to make whatever they're making better.

Q. Are there any common misperceptions VEXTEC faces when introducing Virtual Life Management™ in other industries?

A. VLM combines functional disciplines that are usually stove-piped in separate organizations within the typical corporate structure. Reliability specialists make forecasts of future products based on past product statistics, which don't represent future product physics. Structural engineers perform stress analysis that indicates today's state, but lacks the material reactionary insights to describe how that state will change over time. Business analysts make cost projections and buying decisions that are essentially divorced from how the product actually functions in the hands of customers. All these analyses are deterministic in nature – using statistics from the past to predict some future – and as such, are a great oversimplification of the real world's variability. And it happens every day. For instance, manufacturers look at their past mean fleet failures to calculate their future warranty exposure. But it's not the mean fleet failures that cause the biggest warranty problems – it's the early failures. And those early failures can't be predicted from mean-life calculations. How big of a problem is that? Last year alone, early product failures accounted for over \$40 billion dollars in warranty payments in the U.S. alone, with the auto industry accounting for over 20% of that. VEXTEC is the only company in the world with the computational framework to simulate and predict what's going to happen, based on well-documented behavior characteristics of materials, the physics of



their failure, and the laws of probability. This innovative approach is both proven and patented.

Q. Virtual Life Management™ is currently offered to customers as a managed service; however VEXTEC also intends to release the software to end users. When will the software be available for purchase?

A. The companies we are currently engaged with need answers now and VEXTEC is providing them through our managed service. However, we're also working with these same early adopters to develop the requirements for our first release, as well as the training they'll need to use our software. Over the next 24 months, our software will be made available to these end users, with a general release planned shortly thereafter. Our customers are very pleased with our current managed services approach, because it allows them deploy our technology a small piece at a time and derive value from it right away. But we – and they – also recognize that VLM represents a fundamental shift for the better in the way their products are going to be made and taken to market.

Q. Could you provide a few examples of how Virtual Life Management™ is being utilized today on both existing products and development stage products?

A. Here are three different examples from some of the industries we're working in:

FAA Repair Certification

Companies must certify their turbine engine repair process before they launch their new business operation. The FAA has traditionally certified a new process based on physical testing proof that the repair consistently meets durability expectations. This physical testing, the critical path in FAA approval, usually takes 12 to 24 months to complete.

Now, VEXTEC's Virtual Life Management simulation technology has replaced the much of the physical testing – shortening the process by as much as 80%. This FAA certification was on a new leading edge repair made to a turbine engine blade. The weld repair added a new material to the original blade material. But the welding process also induced enough heat at the bond-line to create a mix of grain structures in the heat fusion zone region. Within 90 days, VEXTEC proved, using the industry's standard Goodman Diagram, that not only was the established safety margin at the engine's operating region maintained with the repaired blades, but that there was virtually no difference between the pristine blades and those that had their leading edge repaired.



Product Manufacturing Controls Trade-study

An automotive parts manufacturer was considering a material processing change to improve durability in their 400,000+ unit product fleet. The processing change would have required a significant upfront capital investment and the OEM asked VEXTEC to simulate the outcome BEFORE the investment was actually made. During the 90-day project, VEXTEC constructed VLM simulators for the product both in its currently fielded condition, and with the “new” processed material. Since the product with the new material had never actually been manufactured, VEXTEC simulated a variety of material formulations.

Given the wide range of casting possibilities from the supplier, VLM produced an entire matrix of expected outcomes. Our analysis clearly showed that the material processing change was a bad idea – luckily, before any money was spent. VLM showed that our customer simply could not affordably maintain the extremely tight manufacturing controls needed to achieve the desired level of fleet durability. As an added bonus, our VLM analysis also identified a means for improving fleet durability by 25% (saving \$1 million per year), by implementing a relatively minor change to the *existing* process.

Aircraft Structures Processing Change

An aircraft OEM customer was considering a change from conventional to orbital drilled rivet holes in 7050 type aluminum structures. VEXTEC was engaged before the new procedure was actually implemented to determine whether the change would negatively affect fatigue life. Within 45 days, VEXTEC produced a VLM simulation comparing both hole drilling methods. Our simulator predicted the change would result in a decrease of 20 percent or more in fatigue life. Based on VEXTEC’s VLM results, the customer decided not to implement the new rivet hole drilling procedure in their manufacturing of aircraft structures.

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