Fusion UV Systems, Inc.

QFD Killed My Pet
(Project)

By improving our product development process, QFD helped us hear our customers warn us to "kill the project."

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Abstract

Quality Function Deployment (QFD) is a recognized method of assuring the quality of new products and services during their design and development. Unbeknownst to even experienced practitioners, QFD is comprised of two systems – one to assure the quality of the *product*, the other to assure the quality of the *process* by which products are designed and developed. By including both in our study, we were able to learn early in the project that what we were sure would be a technological leap, giving indications that it was a leap where customers did not want to go with us.

Key Words

QFD, Quality Function Deployment, Product Development Process

Introduction

Fusion UV Systems is the leading worldwide supplier of ultraviolet curing systems and UV-based process solutions. Our UV curing systems are used in manufacturing, printing, and numerous other applications in a broad cross-section of industries with over 35,000 installations worldwide.

A Gaithersburg, Maryland based division of Spectris plc, Fusion UV Systems developed the microwave technology and produces the equipment used to cure various substances using ultraviolet light instead of heat. UV curing has particular advantages where heat-related deformation of the product to be cured is unacceptable, and its lower power requirements and reduced volatile organic compounds make it more environmentally friendly than other curing methods. Our customer portfolio includes the decorative faceplates for Nokia mobile tele-

phones, the graphic printing on cans produced by Coors Brewing Company, and various processes used in the manufacture of gaming DVDs.

Our leading edge research and development at Fusion UV Systems is responsible for over 100 patents, and the emerging advantages of UV curing have resulted in a growing list of both customers and competitors. Like many technology driven companies, we strive to stay ahead of our customers' needs so that we may help them in ways they may not even know about. With no competition in the early days, this technology strategy met with great success, but as new competitors enter the marketplace today, it has become increasingly evident that future success would come at the nexus where technology meets customer value.

David Harbourne, President of Fusion UV Systems, had heard about QFD from a sister division of Spectris plc and asked his executive team to learn more about it. Dwighd Delgado attended the 2000 Symposium on QFD and was intrigued enough to invite Glenn Mazur to address Fusion's President and executive group. Afterwards, David Harbourne commented that he was impressed by the disciplined approach to understanding customer needs, and declared "this is what we need at Fusion," and wanted to find a way to be personally included in the initial QFD training!

The Project

The existing spot curing industry faces several problems in the field, notably downtime to replace the UV bulbs and changes in life, output intensity and spectrum as the bulb ages. Fusion UV Systems has developed proprietary technology that will improve these and other characteristics of manufacturing with UV adhesives where precision bonding is an essential requirement, rendering the current technology obsolete. Annual sales increases of 200-300% could be expected as a result of this new technology with both existing customers and expanding applications as a result of these improved performance characteristics.

Given this potential, the company was anxious to get the microwave spot cure product to the market rapidly, and with high acceptance in the field. QFD seemed to offer a way to achieve both, by reducing development iterations and addressing customer productivity and maintenance needs as well as internal manufacturability and installation issues. Since QFD was supported by the president, we felt that the first project should be conducted by the next level of management, the vice presidents. Once learning the method, we felt we could then disseminate it to middle managers on the next project. Thus, our executive QFD team members were Miodrag Cekic (R&D Manager), Dwighd Delgado (VP - Manufacturing), Keith Helms (Manufacturing Engineer), Jeffrey Okamitsu (VP - Technology), Adam Quirk (VP - Sales), and David Snyder (Product Manager).

After reviewing our operations and product development system, Mazur laid out a customized QFD Green Belt and QFD Black Belt program. As the project progressed, other divisions requested QFD training as well; to date 70 QFD Green Belts have been trained. The QFD Black Belt program broadened the range of analyses to include prioritization of customer segments and identification of specific customers to visit, signing non-disclosure agreements to protect our emerging technology, customer visits, and technology deployment.

The Methodology

To determine which market and customer segment could be best served by our new proprietary spot cure technology, our team used QFD to identify and prioritize customer segments to help focus the "gemba" visits and "voice of the customer" stages that follow.

We not only identified which market segment and which customer, but also which facilities would make our gemba visits most useful in the shortest period of time. This was accomplished using the Customer Segment Table (5W1H) of who would use the product, what they would use it for, when, where, why, and how they would use the product. For competitive reasons, the Customer Segment Table cannot be shown.

To maximize the cross-section of perspectives gathering the subsequent voice of the customer data, we included a representative from R&D, Manufacturing, and Marketing on each gemba visit. In a similar manner, we also endeavored to include a specific functional cross-section of end customers, which included an operator and/or maintenance technician, a manufacturing, design and/or process engineer, and also decision makers in the purchasing and/or engineering functions.

To investigate and analyze the spoken and unspoken needs of the customer, we utilized a customer visit implementation guide from our QFD Black Belt training. Prior to our first real customer visit, we even rehearsed our roles in a simulated gemba visit with a sister Spectris Plc company in an effort to practice what was being learned.

Only then did we deploy our QFD team to the targeted customer sites, which included a mix of end users and OEM's, in order to understand how he does business, what his customers need, and what problems he has in satisfying those needs. (We had previously experienced the shortcomings of using OEM's to exclusively define customer requirements.)

In the debriefing that followed each visit, we used the familiar QFD voice of the customer table (VOCT-1) to record the inferred or explicit observed application/use context, and to brainstorm new demanded quality needs and to challenge our design assumptions. See table 1.

In this manner we were able to see our product as a part of the customer's system and how it related to other customer activities. The results enabled us to optimize our design and make our spot cure product and project more cost effective.

The Wake Up Call

From the QFD VOCT-1 analysis of the cross-section of end users in our gemba visits, we were shocked to discover that customers had a substantially different value proposition than anticipated.

The largest potential for our spot cure product in volume were customers in a labor intensive environment, who were manufacturing low volume/high mix products. These customers generally were ambivalent about our stable output over longer life, reduced operating costs over life, principally because there were other cost drivers warranting more attention than the UV curing process.

This was made especially apparent by customers who used multiple competitive spot cure products side by side, despite significant differences in performance between these products. Many of these customers preferred to stay with the existing supplier to minimize the added complexity of training and maintenance costs in a labor intensive environment.

However, customers producing high volume/low mix product demanding precision UV curing in a capital intensive environment were most receptive to our product, principally because they placed a premium on stable output over longer life, and reduced operating costs over life.

In these particular cases, material and machine efficiency, and quality of the finished product were the principal drivers to control and reduce unit costs in manufacturing. Unfortunately, these opportunities for our product were quite limited.

We learned that the costs of bringing our new product to market would not generate a return on our investment, even with premium pricing. Our value proposition in performance and technology differentiation was simply not enough!

Furthermore, we discovered that these spot cure systems were quickly becoming a commodity as a "me-too" product in a highly fragmented market, and new competitors also were entering the market.

Through the VOCT-1 analysis, flow charting our observations of the customer's process, and evaluating their cost equation, we learned that it would be extremely difficult to penetrate these markets and gain significant share, despite our value proposition, even at a competitive price.

QFD Lessons Learned

As this was our first experience with QFD, we learned a few things about applying the methodology that are worth mentioning.

We experienced great difficulty with some customers that were extremely sensitive about their manufacturing process and products, requiring a Non Disclosure Agreement in advance, which became very time consuming. Surrogate gembas was our answer to this difficulty.

Our multi-function team composition facilitated more information from different perspectives in less time, and we see much value in this approach. The only change we are adopting is to also include a field service technician.

Even though we were advised of the challenges, we were unable to exclude sales personnel on some visits due to the customer relationships involved. In the future, we will attempt to find another way. It is very difficult for a sales person not to make this a sales opportunity, despite significant communications about gemba visit guidelines.

Coaching from an experienced QFD practitioner on a real project, concurrent with Black Belt training, expedited the skills set knowledge transfer required. Our Green Belt training was only enough to become QFD conversant and dangerous at the same time.

Our single largest difficulty was the debriefing following the gemba visit. We discovered that a large volume of information was gathered at one time with our multi-function team approach. This resulted in multiple debriefing sessions taking more time than originally expected; committed team members are essential for the success of this disciplined process.

Especially important is a strong senior management commitment supporting the QFD process, because the risk of the effort becoming another "quality fad" is very high. Early success in QFD projects also goes a long way in making believers out of non-believers.

Table 1. Voice of Customer Table -1

Info About Person	Voice of Customer	Who	What	Where	When	Why	How	Safety Issues	Integrated Data
Assembler 1 (Dory)	90 second dose, "I know that 5 seconds is enough"	E=Assembler, Female, Tech School Grad or High School, American (Midwest), Middle Aged, Experienced Worker, minimum 5 months training	E=Assembling parts, dispensing adhesive, aligning mirror, and then bonding on Standard Product	E=xxx MN, 20,000 square foot light industrial factory, ESD safe workcell, class 1000 cleanroom,controlled environment, extreme ESD control, low-vibration workbench, ESD protective lab jacket, special hand lotion, finger cots, dust-sensitive environment, crowded work environment one to two foot separation, controlled EMC environment, overhead equipment, shared tools and equipment, UV protective eyewear	E=First shift, one of the last steps, after critical active optical alignment, one at a time, accumulate many, then move to next step, lamp powered on for 16 hours, 90 second dose required, 5 second sufficient	E=precision optical alignment required for precision measurement, step is extreme high value addded, low thermal shrinkage requires, low air chemistry, low moisture chemistry, low viscosity single-component adhesive	E=singly, deliver UV light via handheld lightwand, repetitive back and forth motion of spot across the cure zone, process non-optimized, 90 second dose, "I know that 5 seconds is enough", use integral timer on lamp case, process obtained via trial and error and by advice of suppliers, dymax and norland adhesives, non-precision delivery of adhesive, "hold wand 1.5 inches from surface for 1 inch spot", dose switch on lamp bodyI= potential damage by cleaning crew, I= geometry not right	I=toxicity of chemistry, accidental exposure to UV, E=stray light, perception that light is UV dangerous, toxic solvents	Shorter process time. More precise delivery of light. Better understanding of process and chemistry. Process assistance from supplier. Easy delivery of light. (Into inaccessible areas). Operation should not affect optical alignment. Lamp must operate in cleanroom and ESD safe environment. Lamp must not impact EMC. Degree of cure indication. Faster processing. Potential for repetitive stress injuries. Integrate controls with handheld device. Single hand operation.

Post Mortem

It would appear that the main accomplishment in our initial QFD experience resulted in saving millions of dollars in non-recurring product development costs that would never be recovered.

We generated sufficient information from these gemba visits and subsequent QFD analysis to identify new market opportunities which, when combined with other market intelligence, precipitated development of a different product being launched early next year.

Similarly, our QFD experience changed our product development approach. The QFD methodology is a requirement for other products currently under development, and is viewed as an essential ingredient for Fusion's ongoing efforts to deliver customer value.

References

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About the Authors

Dwighd Delgado is a novice practitioner in QFD, while currently Vice President of Manufacturing for Fusion UV Systems. Prior to his 10 year career at Fusion UV Systems, he was with General Electric for 14 years, in numerous positions domestically and internationally in Manufacturing, Project Management, and Engineering. Dwighd has received multiple Managerial Awards from General Electric, and also from Fusion. He holds a private pilot license, and is a member of AirLifeLine, a group of volunteer pilots who provide air transportation for those in need of medical attention. He is a member of the Aircraft Owners and Pilots Association, and a member of US Sailing, sailboat certified in various categories. He has been President-Elect for the Cleveland Chapter of the Institute of Industrial Engineers, a Certified Quality Engineer, and holds a Master's degree in Engineering Management from George Washington University, and a Bachelor's degree in Industrial Engineering from the Georgia Institute of Technology.

Jeffrey Okamitsu, Ph.D. is currently Vice President of Technology for Fusion UV Systems, with over twenty years of experience in research, technology development and product development in both academia and the commercial world. Past accomplishments include pioneering research in high energy physics at both Columbia University and Princeton University and R&D in photonic instruments at York Technology and Datacolor International. He is currently leading the development of several new products and technologies for use in UV curing applications. Dr. Okamitsu holds a PhD in physics from Columbia University and an Executive MBA from Temple.

Glenn H. Mazur has been active in QFD since its inception in North America in the mid 1980s and has worked extensively with Yoji Akao and the late Shigeru Mizuno, the founders of QFD, on their teaching and consulting visits from Japan. He received the Akao Prize in 1998 for Excellence in QFD, and in 2000 was certified by Akao at the highest level of QFD Mastery, the QFD Red Belt. His current positions include president of Japan Business Consultants, Ltd. and adjunct lecturer in Total Quality Management at the University of Michigan College of Engineering. His voluntary positions include Chairman of the North American QFD Symposia, and Executive Director of the non-profit QFD Institute and International

Council for QFD. He is a member of the American Society for Quality and the Japanese Society for Quality. Mazur holds a Master's Degree in Business Administration and a Bachelor's Degree in Japanese Language and Literature, both from the University of Michigan.