

EMBEDDED IN THIN SLICES

Build an Embedded Systems Consulting Company (Part 1)

The Core Values of a Successful Company

Over the next few months, Bob will look at some of the core values and axioms that have worked in creating a successful embedded systems consulting company. This month he focuses on the core values that make a company effective and profitable.

By Bob Japenga

Many of us now or in the past have worked for large companies where we developed some very cool products, but for a number of reasons, we became bored with the politics, with the bureaucracy, or just with the culture of the company. The pay was good. The benefits were good. Some of the products were cool. But something inside us longed to be able to set our own agenda and do the kind of designs that we could own and be proud of.

Twenty-eight years ago, I found myself in that place. With a great partner (more about that in a later article), we decided to start our own company. Both of us came from the aerospace industry and had been designing some pretty cool stuff (X-wing helicopter controls, Mars lunar probes, etc.). Initially, we thought we wanted to be a product-oriented company. But after several unsuccessful attempts to design and market a great product, we decided to concentrate on designing great embedded systems for others. And we have done this for over 28 years.

There were certain advantages to this path that I now see with hindsight. First and foremost was that we got to work on many different kinds of systems ranging from

aerospace, medical, industrial and commercial embedded systems. This allowed for us to be exposed to a wide variety of technologies. Secondly, it allowed us to keep the company at a size that allowed us to accomplish our mission. As we created successful products for other startups, we saw how the companies quickly grew larger than we were interested in sustaining. We saw the visionaries get bogged down in lots of things that didn't interest us. So as lucrative and scalable as a product-oriented company is, we chose to go with a company that designed systems for other people.

Over the next several months, I want to share with you some of the things that helped us to provide a good living for our entire company over a fairly long period of time. This month I want to share some of the core values on which we built our company. I don't feel they are limited to embedded systems consulting companies, but that is what we did. They are a bit outside-the-box, so buckle your seatbelt and let's get started.

PEOPLE MATTER

As engineers, it is very easy for us to get caught up in the technical details. I love the

Dilbert cartoon where Dilbert is telling co-worker Alice about his visit with another co-worker, Yvonne, to get some data on a joint project. Alice asks how Yvonne is doing after having sextuplets, having her house burn down, and having shoulder surgery. Dilbert's response was: "It didn't come up." We laugh, but this is the way we engineers think. Once, one of our engineers drove to a customer site with one of our customers, whose wife was dying of cancer. When I asked our engineer how this customer's wife was doing, his response was: "It didn't come up." And this was one of my best and most well-rounded engineers.

If we are going to create a company of engineers, we need to hammer home this truth almost daily. One of my guiding principles along these lines was a statement made by Hyman Rickover, the man who directed the original development of the nuclear submarine: "Good ideas are not adopted automatically. They must be driven into practice with courageous impatience."

I love that phrase: "courageous impatience." As leaders of our own companies, we need to exercise this all the time. This core value will not be adopted automatically at your new company either. You and others will need to drive it into practice almost daily.

Another mentor of mine once said: "Vision leaks." What that means in your company of engineers is that you will need to continue to place this vision that people matter before your team. And live it out yourself.

People matter more than projects, successful products, budgets, the bottom line, and schedules. I believed that this principle was an essential core value that we needed to hammer in relentlessly into our heads and those of our employees.

How you drive this into practice will require creative energy on your part. You will mold specific practices and principles that will help your team live out this core value. At our company, the fruit of this can be seen in the fact that no engineer has left the company for another engineering job in all of its 28 years.

WORDS MATTER

The other day, I was listening with my 10-year-old grandson to one of his favorite songs. The lyrics were age inappropriate. When I asked him about the lyrics, he told me that the lyrics don't matter. What he said was that what matters is the rhythm and the music. The words don't matter. I hope that most of us would agree in this case that the words describing sexually explicit adult situations do matter when listened to by a 10 year old. But very often in business relationships, people want to just move forward quickly and not

EARLY WORK

The Sikorsky S-72 X-Wing could take off like a helicopter and then stop the rotors which then became a fixed wing for horizontal flight. My business partner and I headed up the quad redundant embedded software design teams. For more information, visit: <http://bit.ly/2eGD9dm> and <http://go.nasa.gov/2eSb55Y>.

Before launching out on my own, I worked for a short time on the design of the guidance system for the Viking Mars Lander. I analyzed gyro data from our long-term tests. Our guidance system didn't actually guide the unit down to Mars. Rather, it took guidance data to analyze the atmosphere on Mars. Remember that this was the first spacecraft to actually land on another planet. You can learn more at: <http://mars.nasa.gov/programmissions/missions/past/viking/>.

carefully write out the words that define the task or specify the requirement.

Over the years, we have found it essential for every project to do two things. Carefully write out a statement of work (SOW) describing exactly what's expected of the employee or us the design firm. Also, create a detailed requirements document at each stage of the project.

Sometimes my attention to the details of words overwhelms my customers with too much information. Some partners have said that we should keep it simpler for the customer. Often we have found that our customers trust us so much that they do not even read all of these words that matter so much. But when things go bad, as they often do, these words that matter will help you sort things out with a customer.

So if you want to build a company that lasts with engineers who generally would just like to start drawing the schematic or write the code, words matter. Take the time to write clear and precise statements of work and specifications.

Words also matter in sustaining long-term relationships. If you want to stay in business for a long time as we have, you need to handle your words very carefully. Once I had a very difficult discussion with a good customer. At the end of the conversation, I wanted to convey that, even though the most recent project was in trouble and that he owed us a lot of money, we really enjoyed working with him and his team. It was late on a Friday night. (Aren't these kinds of discussions always late

on Friday nights?) I closed the conversation by saying: “It’s been nice working with you.”

Words matter. These words, on their own, convey that we have enjoyed working with him. But in the standard usage it means: So long. Farewell. Auf Wiedersehen. Good bye. We won’t be working with you anymore.

By not being careful with my words I caused this customer angst and grief over the entire weekend because he wanted us to continue on this project. Because I was careless in my words, he thought that we were done working with him. Words matter.

CREATIVITY MATTERS

As we work together as a team and with our customers, it has been a joy to see creative and inventive solutions to real problems happen on a regular basis. This core value also affects our hiring policy and commitment to personal and professional development of our employees.

If you are serious about creativity in the work place, there are a couple things you need to consider how you configure your workspace and how you handle meetings. We decided early on that good creative designs need focused attention. So, after the first year when we moved out of my basement, we chose workspaces where our engineers would have private, quiet places to release their creativity. Every engineer needed his

own office with a door. Some offices are not conducive for that. Pick an office that allows for solitude. As one engineer told researcher Sherri Turkle, “when she needs to think, she works under a desk.”[1] So first we need a work space that provides places of solitude.

And that solitude needs to be a place to think and create—not to network with those outside your space. Limiting phone calls and emails during these times is essential. Earbuds for listening to music is a whole different topic much beyond what we are covering here. When you create your company, you will need to monitor each person’s productivity and creativity with and without “always-on music.” Encourage your employees to try a month without and see if they notice any increase or decrease in productivity and creativity.

But there is a conflicting requirement to providing places of solitude to think. We also need to provide an environment where we encourage dialogue and conversation. Turkle’s research has shown that there is a direct correlation to productivity and creativity in a work place that encourages collaborative conversation. To paraphrase Turkle, the alchemy of engineers sitting around a table can sometimes spark conversations that lead to a new idea. But we need to be careful that these don’t become another meeting.

MEETINGS

When I interviewed for my last job, I asked the VP of Engineering how many meetings I would have to attend. He immediately called his key program managers. They reported that the project I was working on had two meetings a week. What he didn’t tell me was that the project hadn’t really started yet. These were preliminary design meetings with the systems people and high-level electronics people. By the time I left to start my own company seven years later, more than half of my time was spent in meetings.

Somehow we have to find a way to encourage the conversations that spark new ideas and discourage the “How can I stay awake” meetings that so characterize so many companies. How do we do this? We encourage the following kinds of environments.

Design Reviews: We attempt to schedule many design reviews during a project. Not just those that are toll gates to the billing milestone and next phase of the project. Actual working reviews that are more interactive than the formal reviews. We still have the formal reviews but these are separate. The presenter isn’t required to have pretty pictures, but needs enough presentation so that the design can truly be reviewed. We keep these meetings to under an hour. An



ABOUT THE AUTHOR

Bob Japenga has been designing embedded systems since 1973. In 1988, along with his best friend, he started MicroTools, which specializes in creating a variety of real-time embedded systems. With a combined embedded systems experience base of more than 200 years, they love to tackle impossible problems together. Bob has been awarded 11 patents in many areas of embedded systems and motion control. You can reach him at rjapenga@microtoolsinc.com.

REFERENCE

[1] S. Turkle, *Reclaiming Conversation*, Random House, 2015.

RESOURCE

T. Peters and R. Waterman, *In Search of Excellence*, HarperBusiness Essentials, 1982.



hour and one half tops.

We encourage these to happen not just when the design is finished but whenever the designer has reached a significant architectural or design decision. We also encourage them when we are stuck on a problem. We like to encourage our engineers to not go more than a few hours on a project without getting help. We will talk more about that when we discuss our business axioms in a later article.

Management by Wandering: Implemented by Abraham Lincoln during the Civil War and formalized by Tom Peters this method of management is a great tool for encouraging conversation and spontaneous dialogue. Great questions you can ask are: How is it going? How can I help? Do you need more resources? The employee needs to know that this is not a review and that you are there to help.

Ice Cream Time: Our business is right near a frozen yogurt shop. Every Friday, several members of the team walk down together to have frozen yogurt. Do they always talk about work? No. But productivity and creativity are all about creating an environment where the engineer can flourish. I believe that Ice Cream Time is doing that.

Regular Scheduled Times of Personal

Sharing: Finally, we have formalized regular times of personal sharing every two weeks for 45 minutes. There are several reasons for this. One is that we are building a sense of community. But one of the goals is to reduce the amount of personal sharing that goes on during the informal conversations. The hope is that the employees will talk about their projects.

MORE TO COME

If you have read this far, you are probably interested in starting out on your own. Be patient, more important stuff is coming in our future articles about creating an embedded systems consulting company. But of course, only in thin slices. 