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Learn From My Many Mistakes

When engineers are doing the building, you can't contain your labor costs or your medical costs for missing fingers.

By Mike Rainone

In December, I wrote about some of the tribulations with the start up of Active Water Sciences, LLC, one of PCD's affiliated companies that has the sad misfortune of having me as its CEO. At this point, it might be interesting to catch up on what has happened, with the aim of allowing you to learn from my many mistakes.

Late last year, we began working 12 hours a day, seven days a week, to produce the first two units of our new product, a revolutionary wastewater treatment system. Six units in all had been purchased by the military and two were due to be shipped to Afghanistan in mid-January. Housed in 20-foot shipping containers, each unit was destined for a separate Forward Operating Base (FOB), and could serve a base of about 600 service personnel.

The overall architecture for this technology is comprised of three 20-foot shipping containers. One container houses a control unit, which consists of the computer; a fermentor for the bacteria (the key to the operation of the system); a generator and filter.

A second container holds the treatment unit, the heart of the system. The treatment unit consists of two large tanks of membrane bioreactors and a primary sedimentation tank. Finally, a buffer unit also houses two tanks, one for surge acceptance and one for equalization, which provides a steady stream of wastewater to the treatment unit.

Over a six-week period, we quickly designed and built two such systems. While we didn't make our mid-January deadline, our distributor, who had anticipated how awkward we would be in building these units from scratch, moved the deadline to the end of the month, and we were able to ship in time to meet the new deadline.

I'm proud to say we have moved from a perfectly functioning operational prototype to a very polished, professional, robust and over-engineered production unit.

LESSON #1: Never tell your staff the real deadline. In this case, lying is good, because the work will expand to fill the allotted time.

Our story isn't really a tale about engineers running amok. Our story involves engineers worrying about the future. Here's the scenario: our units are headed to Afghanistan where a Maytag repair man can't just zip over to your FOB to fix giant wastewater processing units, at least not without an armed convoy. We can't send our guys over there every time something needs a tweak or a whack to start operating properly again. So we've had to try and imagine every possible scenario of failure, sabotage, stupidity or bungling.

Compounding this is the fact that our product will be on display to every environmental officer in the U.S. armed forces, NATO, the U.N., and nearly every other disaster relief group on the planet.

While we believe our unit is unsurpassed, the rest of the world is looking for proof. Failure is not an option at this juncture and given these inducements to perfection, engineers can and will run amok — and you can't do a darn thing to stop it.

LESSON #2: At a minimum, try to avoid a situation in which your engineers are actually doing the building. They will look to the ends of the earth for ways to improve the design, on-the-fly, regardless of the cost, especially if they have wrenches in their hands. When engineers are doing the building, there is no way to contain your labor costs, nor your medical costs for missing fingers.

Given the $800,000 price tag for the two units, one can appreciate the importance of having a terrific banker lined up to help even out the potholes in the cash flow regulation. Unfortunately, that banker relationship I bragged about in December, fell through. After sitting on our loan request for nearly two months, we were denied.

Our primary lender's cowardice was saved in three ways. First, our customer put up a sizable down payment for every unit, which was appropriate and helpful. Next, the local economic development foundation put up a substantial loan, with the requirement that we actually remain in the area and employ a certain number of people for the duration of the loan. Finally, our university partner's bank, treasuring the $200 million that the university runs through the bank every year, granted us a substantial line of credit.

LESSON #3: Never trust a banker, no matter how long you've known him. Also, set a deadline for reply and move on if he misses it. Don't feel bad about hurting a banker's feelings — you know he won't feel bad about hurting yours.

The toughest lesson of all is that, at some point, you have to let go of your baby and get it out the door. It will not be perfect. It will have some flaws. You will know you can do better. You will lose sleep over something you just can't put your finger on. Oh, and it will be the first time the technology is tested in the real world, and every person that can make a difference in your future will look at it and judge it. This all makes that first launch exponentially tougher.

Late last year, we began working twelve hours a day, seven days a week, to produce a revolutionary wastewater treatment system.

Maybe every aspect of launching any new business is like that. Maybe you can never have enough money, and maybe you're always uncertain. Somehow, you soldier through, making the best decisions you can.

LESSON #4: You must eventually trust your design, your engineering and trust that your Failure Modes & Effects Analysis (FMEA) process has brought your product up to the best possible standard before you launch—but launch you must.

Despite all of the trials mentioned above, the final lesson is that it is all worth the effort. Once your first product is shipped, orders are coming in and you've done it on your own, it all becomes clear.

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Occam's Razor, Resharpened

Sometimes, out of the blue, comes a reminder that the best solutions to a problem are not necessarily the most complex.

By Mike Rainone

The Franciscan Friar William of Occam said it best about 700 years ago in the form of the principle of parsimony, which we now know as Occam's Razor.

William said "entia non sunt multiplicanda praeter necessitatem," which for you non Latin speakers (Who is a Latin speaker these days?) translates to "entities must not be multiplied beyond necessity."

Translated into engineering English, that means the simplest explanation is usually the best, and big convoluted explanations are just prima facie evidence that you either don't know what you are talking about or you may be trying to confuse things. For the antithesis of Occam's razor, listen to anything Alan Greenspan ever said to Congress.

The most recent reminder was in a report in December's Journal of Vascular Sciences from an Italian physician who, when faced with his wife's impending demise at the hands of Multiple Sclerosis (MS), began a systematic investigation of the etiology of the disease, and coincidentally may have found a cure. Not in a new drug, but in a simple surgery that is done every day, all over the world.

For anyone unfamiliar with MS, it is a debilitating neurodegenerative disease apparently caused by the deterioration of the myelin sheath that surrounds many of the important nerves in the body, especially in the brain.

Until now, serious thinkers in the field, those supported by Big Pharma anyway, believed that MS was an autoimmune disease. For some reason, the immune system goes crazy and attacks the myelin sheath in the brain. People with MS suffer from a plethora of symptoms, such as cognitive and motion impairment, visual problems, loss of dexterity and other unpleasant disabilities that worsen with age.

Early work in the field focused on looking for a cause, but much of the work today seems to center on rebuilding the myelin sheath with drugs, with the hope of helping those with long term deterioration reverse the damage. Obviously, such work would also give hope to those in the early stages of this disease, who face a lifetime battle with the effects of the deterioration.

Dr. Paolo Zamboni took a different approach. He looked at early studies that suggested a buildup of iron was at the root of the disease. Zamboni is not a neurologist. He is a vascular surgeon, and with that background he was able to look at this problem from a different angle — blood flow, not autoimmunity.

Zamboni, who had been working on the correlation of iron buildup and the damage it caused to blood vessels in the legs, looked at blood flow from the brain, specifically the veins that drained the brain.

In what looks to be a fairly well done, if limited, study, he found that virtually all MS victims had constricted venous drainage from the brain. Furthermore, he found a significant build of iron in those veins, as well as a blow back of that iron laden venous blood into the brain.

From his earlier work on the inflammation and cell death that results from iron (and other heavy metal) build up in legs, he hypothesized that the myelin sheath destruction happens because the excess iron attacks the veins in the cranium which produces inflammation and an immune response. This allows the immune cells to leak out of the damaged veins, on the brain side of the blood brain barrier, misidentify the myelin sheath surrounding the nerves in the brain as foreign tissue and then go on a search and destroy mission. So, to the extent that the immune system is attacking one's own myelin sheath, MS is an immune disease that is provoked by vascular system problems.

Zamboni's solution was a vein-opening vascular procedure akin to angioplasty, in which a balloon catheter is inserted through the groin and routed all the way to the jugular. The balloon is then inflated to open up the constrictions in the vein. Can you imagine the reaction of the medical community in the U.S. to this heretical approach?

Zamboni began doing angioplasty on a series of MS patients, opening up the veins to allow the patient's brains to drain properly. The results were staggering. Of the 65 patients who underwent the surgery, 73 percent were symptom free after two years, including Zamboni's wife.

> "Don't be fooled by conventional thinking."

Needless to say, he has stirred up a hornet's nest in the MS community, and those suffering from the disease are now clamoring for testing and surgery. Meanwhile, those pursuing the old paradigm are cautious. Apparently, the MS societies in both the U.S. and Canada have issued statements of caution.

In the U.S., the MS Association has allegedly issued a statement urging MS patients not to be tested for blockage or surgical treatment. Interestingly, after a quick search of the MSAA website, I could find no mention of anything having to do with Zamboni, Chronic Cerebrospinal Venous Insufficiency (CCSVI) or Liberation Treatment. I did find plenty of references to drug treatments. Perhaps they think that if they ignore it, it will go away.

So back to my thesis: Zamboni, because of his unique background as a vascular surgeon and university professor, the husband of a victim of MS, and someone not co-opted by Big Pharma support, was able to get past the assumption of autoimmune disease and look at an old problem with fresh eyes. There are lessons in this story for all of us.

Don't be fooled by conventional thinking. What did not work in the past may work now. Technology improves inexorably, and be sure to examine the incentives of those who are doing the conventional thinking.

Sometimes things outside of the truth influence and corrupt the search for truth. I would never oversimplify this complex world, but going back to the basics and questioning all assumptions is always the best place to start.

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The Small Business Conundrum

One person's pork is another's pork chop.

By Mike Rainone

Many of you reading this column may work for a small business, or perhaps aspire to own one.

Congratulations. According to Henry Paulson, Alan Greenspan and seemingly everyone else along the beltway, small businesses are the key to this nation's recovery.

Small businesses account for 52 percent of all the jobs in this country, and conventional wisdom says that if we can just get them to hire more people we can turn this thing around. Unfortunately, no one really has a plan to make that happen.

Recently, Paulson and Greenspan talked about how small business would be generating jobs, but admitted they didn't know how those jobs would be created. That's when it dawned on me; they don't understand where the business of small business comes from.

It's like a cartoon scientist writing a complex formula on a board, but in the middle of the formula is a box that reads, "This is where the magic happens." For economists, the magic is where the "orders" come from to feed the creation of jobs in small businesses. That's the conundrum — small business owners seem to be an abstraction to those who govern our lives.

This should not surprise anyone. Paulson was the chairman of Goldman Sachs, hardly a small business. Greenspan, the academic ideologue purveyor of gobbledygook and former Fed Chair, is the man who almost singlehandedly dug the giant hole we're trying to dig out of.

Both of these men seem to believe small business owners would commit to hiring additional employees if they were more taxes, healthcare, interest rates, financing or all or none of the above.

Do taxes keep me from hiring if I am a small business? Not on your life. If I have work, I will hire like a maniac to keep the customer happy. How about healthcare? I already pay an outrageous amount for healthcare for my employees; another employee to fulfill a contract is irrelevant. How about interest rates? Get a grip. I don't care about interest rates as long as the work is coming in to keep my folks busy.

What are the economists missing? Small business grows when it has places to sell its goods and when others demand its products. But, what produces the demand? In many cases, demand comes from big business. In fact, much of what small businesses produce is related to larger businesses outsourcing production or services.

You'll notice I've skipped financing for small business. Of all of the macroeconomic factors that restrict small business, financing may be the key. The excuse du jour for tight credit is credit constrained, a euphemism for the fact that banks are avoiding small business lending like we all had the plague.

In a recent column, I optimistically stated that one of the tenants for small business success was to get to know your banker. I told the happy story of a 10-year relationship with our banker who assured me his institution would be good for whatever was needed to help grow my newest company, Active Water Sciences (AWS).

Sadly, after passing nearly $2 million through that bank in the past year alone, I've been told even a small line of credit is impossible under current constraints—so much for perfect credit and long term relationships. The bank lemmings have stopped running off the cliff and are now running around in circles.

The primary reason small businesses are having a tough time creating jobs is that until there is an increase in demand, there is no reason to hire. Until big business begins to purchase more goods and services, small business has no reason to expand. We are stuck in a nasty loop. Perhaps, this is where the government can make a difference.

When the President begins to allocate $30 billion from the TARP funds to small business, he will be seeding the very ground that will bear the fruit that will drive this recovery. Unlike banks, we won't put the stimulus money in an account to strengthen our balance sheets.

Unlike banks, we'll hire people to produce goods and services.

As an example, I point to AWS, a new wastewater processing company that has sold $2 million in units to the U.S. Army. This technology was the result of one of the best sources of funding for unfulfilled needs, our government.

Unlike banks, small businesses will hire people to produce goods and services.

The Air Force realized the need for wastewater processing on its temporary operating bases, so they funded early research. When money ran out, they worked hard to pass it to the Army. The Army understood the need and continued to fund the development.

As it turned out, this technology has applications beyond servicing our troops; it offers promise for disaster cleanup in places like Haiti for third world survival, or even for routine waste processing in this country. And when I say the Air Force and the Army funded the technology, I mean that it was a congressional set aside. It was pork.

So, the next time someone starts yelling about pork, remind them of the clean water being produced in Afghanistan, and perhaps the third world. Remind them of the small business—that employs more than 20 people in Texas—producing a technology that offers the potential to save the vulnerable from water borne diseases.

Remind them that the federal government has a rightful role in the development of hard-to-finance, important technologies that banks and venture capital lemmings won't touch, because they lack sex appeal. Remind them that one person's pork is another's pork chop.

That, Mr. Paulsen and Mr. Greenspan, is what feeds the engine of small business. We will be happy to create jobs and restart this economy, if you will just dust off your checkbooks.

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We Are Under Attack

By Mike Rainone

Our only salvation is to out-innovate the rest of the world

In March, I spoke at the World's Best Technology (WBT) conference in Arlington, TX. I addressed a large venue of venture capitalists and other parties interested in my company's new wastewater treatment system, the Water Phoenix.

This national conference is part of Arlington's grand plan to bring high-tech innovative companies to the region. It is an attempt to create and nurture a culture of dynamic innovation — not unlike that created by Silicon Valley in CA, the Research Triangle in NC or Loop 128 around Boston.

Jurisdictions across the country are attempting to do the same, and they each realize that domestic money has allowed China, Korea, Taiwan and Japan to become major powers. The only way to survive is to maintain and increase the single edge that we still have as a nation; our ability to create and develop cutting edge technology. Our only salvation, in other words, is to out-innovate the rest of the world.

We need to re-grow the infrastructure of innovation, which in my estimation comes from four major factors. It requires:

- Great educational institutions from the primary to the university level.
- A willingness to take risk through a culture of entrepreneurship.
- A broad-based financial infrastructure which is not risk averse, and which provides everything from seed capital to venture capital to a banking system.
- A culture of innovation.

As the people in Silicon Valley demonstrate quite well, if you build and nurture the culture, innovation will come.

Venture funds are drying up, and an increasing number of us would rather work for banks than take the risks of entrepreneurship. Our educational system is increasingly preoccupied with politically- and religiously-correct doctrine, and we seem to have lost our focus on science and math. In short, our educational infrastructure is not up to the task of providing the educated manpower for a technological future.

How do we rebuild our societal infrastructure to nourish the creators, inventors and entrepreneurs willing to take risks and create new products? How do we prepare our children to battle for our economic survival?

We must first understand that this is not a regional problem; it is a national concern, and we must recognize the importance of the federal government's role in providing leadership and funding. Only the federal government has the resources, the bully pulpit and the media reach to get us all marching in the right direction.

Emphasize Education

Back in 1957, when Sputnik scared us out of complacency, our federal government embarked on a huge campaign to increase science and math education by funding many math and science enrichment programs. Today, we have to re-emphasize these disciplines and demand that our schools do a much better job in making science and math attractive and engaging for young minds. And we must provide the funding for this effort.

Reward Risks

Entrepreneurship should be rewarded and encouraged through tax laws and mentorship. The Small Business Administration (SBA) should be strengthened and taken seriously. Instead of working through banks, the SBA should have its own funding source and be encouraged to fund innovative, high-tech start-ups. The Center for Entrepreneurship at the University of Texas-Arlington is an example of an organization at the forefront of this movement. Such organizations should become hubs for entrepreneurial activity that is supported with funding, management assistance, new product development assistance and other resources.

Currently, university leaders are being asked by legislators to help defray the burden on taxpayers by working to turn their research efforts into profitable endeavors. Commercializing our inventive national work should be encouraged, especially in light of current competitive shortcomings.

The Role of the Government

Private money has become risk averse and extraordinarily scarce. To believe in the private market to provide enough seed funding to create a high-tech infrastructure is delusional.

The federal government has to make funds available to seed startup development companies. Nearly every government agency participates in Small Business Innovation Research (SBIR) programs. SBIR grants allow agencies to find the development assistance they need, and it also allows small businesses to find problems that they are qualified to solve.

> If you build and nurture the culture, innovation will come.

Unity of Purpose

It is near political suicide for Democrats and Republicans to join forces on any issue. As a result, our Congress seems incapable of cooperation and collaboration. We have created a national zero-sum game, and neither side seems to recognize that the real battle is with the far east. We are in an all out economic war and if we can't work together, we will continue to lose.

We need a unity of purpose, a common goal to unite and drive us forward. In the late 1950s, our zeal was fueled by the space race. There was also a serious concern that without the heavy-lift rockets that could send us to the moon, and lift a nuclear warhead (coincidentally), we would be vulnerable to attack from the Soviet Union.

We are now under attack in a far more insidious, subtle way, but the stakes are the same. Today, our place in the world economy, our standard of living, our freedom and our way of life are on the line.

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