proto labs®
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CHOOSING THE RIGHT PROTOTYPE

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→ WHAT'S UP?

It occurred to me recently that we are not only in the business of prototyping, we are also involved in the prototyping of businesses.

When you think about it, Proto Labs was the original prototype for a quick-turn injection molding business. Hadn't been done before, the concept wasn't proven, and nobody really knew if it would fly. Happily for all of us, the Proto Labs business design worked even better than founder Larry Lukis had envisioned. The company took off. We tweaked our offerings over time, improving performance and adding new capabilities. The market responded well, and Proto Labs grew.

But as the marketplace for our products became increasingly global, we realized we couldn't afford to ignore the opportunities overseas. We decided to expand into Europe. The only drawback was that we had no idea how to do it. So we created a new prototype—a subsidiary in England based on the lessons we learned in the US.

Business in Europe flourished, with more than 120 employees at the UK facility today, plus sales offices in Germany and France.

Then came Japan. With its extraordinary tradition of innovative product design, it was a perfect fit for our services. Did we have any experience with manufacturing in Asia? No, but we did have a great working prototype in the UK to use as an example. So off we went.

Now business in Japan has grown to the point that it's about to outgrow the original facility, so we will be moving that facility to a larger site. Luckily we just expanded our operation in Europe, moving to a newly-leased 130,000 square-foot facility, so we can leverage that experience. The next step in Japan will probably be multiple sites, and when that happens, we'll look to our 'prototype' in Maple Plain, Minnesota, where we have three sites...not to mention another one in the works in the general area in the coming months.

So that's how we've applied philosophies of prototyping to our own business, by testing our strategies, processes and technologies to innovate, improve and grow.

Brad Cleveland, CEO
brad.cleveland@protolabs.com

HOW ARE WE DOING?

"AMAZING! The speed with which you turned the parts around is a complete game changer. I anticipate using Proto Labs often."
— Tyler Williams, Moto Excellence

"The feedback and the help we received on our design was fantastic. Your staff was very knowledgeable and made the process of getting parts very easy."
— Ed Perzyk, TK Holdings, Inc./Takata

"You did what you said you would and that's a somewhat rare commodity today. Thanks for a job well done."
—Charles Heger, Zircon Corporation

"Keep up the great work so I can continue to impress my clients!"
— Ray Reynolds, Lighting Science Group Corporation

"Great company to work with! A fantastic place to start with a new product."
— Greg Amundson, CornerFlex Insta-Trim

"Excellent quality and breathtaking speed! A refreshingly drama-free service, I look forward to our next project together."
—Stuart Cooper - Xylotek

Adafruit iCufflinks v 1.0

For those rare occasions when khakis and a Code Monkey tee just won't cut it, here's an item that'll make you feel better about donning a dress shirt AND vault you into the vanguard of geek fashion forwardness: LED iCufflinks from Adafruit. CNC machined from premium 6-series aluminum, the links pulsate suavely in the 'breathing' LED design used on Apple devices. But wait, there's more!! These beauties are completely open source (source code, circuit board files, schematics and CAD files posted on GitHub), so you can hack them to create whatever pattern you like. No need to sulk, ladies, the necklace version is on the way. www.**adafruit**.com/products/379

Tagg™ Pet Tracker

Speaking of high-tech wearables, you can stop fretting about your pet wandering off and getting lost, thanks to a nifty GPS device that clips to a dog's or cat's collar. Lightweight, comfy, waterproof and fashionably minimalist in design, The Tagg Pet Tracker not only allows you to locate a lost pet, but alerts you by text message or email when your beast breaches a virtual perimeter that you pre-set. Off-label use for teenage kids? The manufacturer doesn't mention it, and we're not necessarily recommending it...in print. www.**pettracker**.com

Engineers Without Borders

The MDs don't have a corner on global altruism. Founded in 2002, Engineers Without Borders connects engineers with professionals in public health, anthropology, business and other disciplines to develop projects that help people lead better lives. EWB focuses on relatively small-scale projects that are planned, designed and constructed in partnership with local organizations—projects ranging from road construction and erosion control to pumps, wells, irrigation and sanitation systems. If you want to use your engineering skills to do good, this could be a great place to start. www.**ewb-usa**.org

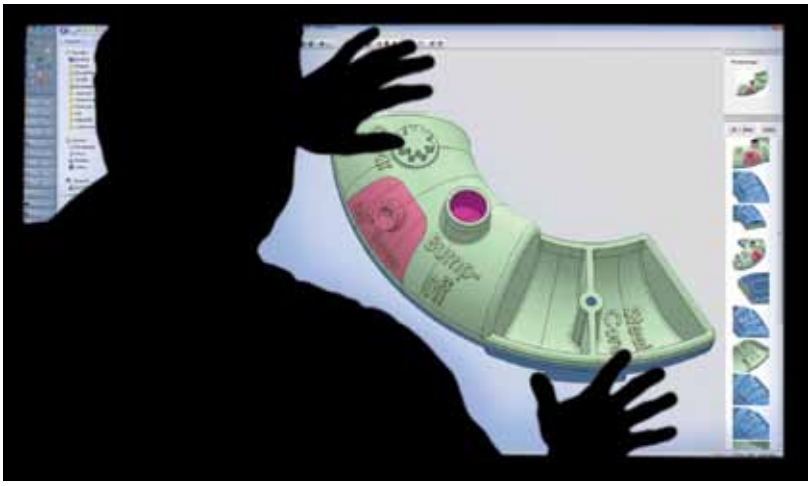
KOR fx 4D media enhancement

Part technology and part psychology, the KOR fx (stands for Kinetic Omnidirectional Resonance) heightens any gaming, movie-watching or music-listening experience to a new level of intense other-dimensionality. Using speakers draped over your shoulders and a console that connects to any device with audio, the KOR sends low-frequency vibrations into your chest cavity, activating neural pathways to the limbic center of the brain, triggering powerful, emotional, immersive "you are there" responses. Fun fact: The KOR was developed by physicist Shahriar Afshar, who, disturbed by the relentless rumbling of gamers in his housing complex, developed the KOR in the spirit of "if you can't kill them, thrill them". Available November 2011. www.**kor-fx**.com

Genius Wireless Ring Mouse

You may not have realized that what was missing in your life was a mouse you wear on your finger. But think about it. For trackpad haters, this wireless, thumb-controlled wonder that connects to a USB nano/pico receiver on Windows machines is a no-brainer. If you could use an excellent and elegant controller for photo slideshows or projected presentations, the Genius is the answer. (It's got a range of about 30 feet.) Or if you work in cramped conditions—on an airplane, for example—just slip on your Genius and you are in business. Plus its tracking sensitivity has awesome possibilities for mobile gamers. www.**geniusnet**.com (search ring mouse)

Maps, Gaps, and Prototyping Apps:
Choose the Right Prototype for the Job



map/map/*noun:*
A diagram or collection of data showing the spatial arrangement or distribution of something over an area

In everyday use, the true value of a map is a combination of what it shows and what it leaves out. We accept the fact that a map, even the interactive one scrolling by on the GPS, is leaving out some potentially important details. It gives us the information we need to get where we're going in a compact and readily accessible form and is a useful tool as long as we don't make the mistake of confusing the model with the real thing. That is the same challenge we face in the use of prototypes in product development.

In a very real sense, the sketch on a napkin or the back of an envelope is a prototype, though extremely simplified and preliminary. So is the blueprint, the cardboard and tape mockup, and the 3D CAD model. Each tells us something, but not everything, about the entity it represents. Depending on where we are in the development process, that "something" may be all we need, but as development proceeds, we need more detail in more dimensions and with more precision. The challenge is to balance cost and time constraints with the amount and kind of information we need at each point in the process. Knowing how to maximize information while minimizing cost and delay can help simplify decisions along the way.

Take, for example, the shell for a handheld electronic device. A 3D CAD model will show, with some precision, how sections of the shell will fit together. What it won't show is how warm or cool it will feel, whether the snaps will hold, or how the light will reflect off the surface. Nor will it tell us how effectively the shell will protect against radio frequency interference. It won't tell us how it will balance in the hand or how natural the key positions will feel under our fingers. And there will be no way to know for sure whether the gaskets will effectively keep out moisture or what damage may result from a four-foot drop.

A prototype made by an additive process like SLA or FDM will give us a real-world model that we can hold in our hands. But, like a map, it will only give us a limited representation of the actual object we are developing. Its layered surface will not match that of a machined or molded plastic part. And unless we plan to mold parts of the same resin used in the additive process, characteristics like weight, feel, strength, and RDI shielding won't match either.

In short, product development may use a variety of methods to get where it's going, but it's like a drive through an unfamiliar area. Even with the best map in the world, you

still base your driving decisions on the real information that comes through your windshield, complete with potholes, sewer construction, signs, semaphores, and other drivers.

Chris Crowley, president of Table Mountain Innovation in Golden, Colorado, knows the value of "real" in the development process. His company helps client companies develop products for medical, petroleum, military, and consumer applications. And while he uses a variety of tools in the development process, he relies on molded prototypes made from actual production materials for data that can't be found elsewhere. **He's identified five areas of concern:**

1. Moldability is as important in a molded part as any of its other characteristics. CAD models and additive prototyping methods can easily reproduce problem features like 0° draft and undercuts; a molded prototype will not. Quick turn molding lets a designer find problems early in the design process instead of as the project nears production.

2. He cites regulatory testing—in which only real materials can be used—as another critical issue, and describes a part for a medical device. "Early in the design process, we made a quick functional prototype mold [and] found that these parts did indeed pass a required FDA flammability test. ...a cast urethane part, a common method for making quick visual mock-ups, would not give us the data we needed."

3. Nothing but a molded prototype can match the appearance of a molded part, and aesthetics are an important marketing concern. Crowley identifies issues like the mold blush, warp, sink, gate vestiges, and ejector marks, and the fact that only a molded part can incorporate a designer's custom colors.

4. Molded parts are ideal for durability and environmental testing. Crowley cites a seismometer designed to be thrown, literally by the hundreds, from a moving truck. Prototypes had to withstand 25 drops from nine feet without damage, a test that could only be performed on fully functional prototypes.

5. Finally, there is the need to test moving parts designed to function within a mechanism. In one instance, according to Crowley, "We actually tried to use SLAs, but they had a rough surface finish and didn't work correctly," In its place, a prototype molded from the actual material to be used in production—acetyl, which has some self-lubrication characteristics—solved the problem.

Proto Labs Senior Engineer, Kevin Crystal, recently completed working on Proto Labs' newest design aid (Protogami), an internal project that required 21 separate plastic prototypes over the course of development. "Each Protogami was a complicated mechanism that required precise folding of 18 living hinges, a variety of closely-fitted clips, and correct placement of 24 inserts," says Crystal.

Over the course of development, developers graduated from paper models and cardboard mockups through 3D CAD models to machined and molded prototypes. "Each one served a different purpose. CAD was quick and virtually free, but the fit and flexibility we needed couldn't have been tested in CAD," says Crystal. "Machined parts were an important step along the way, particularly for non-moving parts, but the only way we could really see how the molded pieces would assemble and move as a complete assembly was with molded prototypes."

In later stages of the project, developers presented prototypes to Proto Labs' worldwide marketing group and collected feedback that was used to simplify assembly and operation of the finished product. "The only way we could analyze real operation of such a complex device and get real-world feedback was with real prototype parts, and every additional step made the end result better," says Crystal.

20 years of the internet

Websites, applications and blogs for engineers

Stacy Sullivan, Media Manager, Proto Labs

Having recently celebrated the 20th anniversary of the World Wide Web, (August 6, 1991 was the day WWW inventor Tim Berners-Lee made the web a publicly available service on the internet) the gang at Proto Labs thought this would be a good time to give a shout-out to some of our favorite sites for engineers.

plastics.inwiki.org

This "free plasticopedia that anyone can edit" offers more than 1550 articles at last count, on all matters plastic—processes, materials, additives, manufacturers, equipment, suppliers and, intriguingly, "polymer personalities." Bios of favorite plastic people, anyone? Also noted: The section on rapid injection molding states that the process is so fast you can get parts in 2-5 weeks. HELLO! It seems there are people in the industry who haven't yet heard about Proto Labs.

thinkgeek.com

The online superstore for geekery of every description, thinkgeek.com has it all—from toys and gadgets to edibles and apparel. Perhaps you could use a Star Trek Enterprise Pizza Cutter that lets you "boldly cut pizza where no man has cut before." Or how about the RageGage Dynamic Smash Pad desktop anger management system? Go forth and spend—you'll be in nerdmerch nirvana.

ides.com

Home of the world-renowned Prospector database, the IDES website is a mother lode of polymer knowledge, with its search engine and informational resources for tens of thousands of resins. Each of the more than 84,000 plastics data sheets on the site includes extensive info on design and processing, as well as material properties.

efunda.com

Need a quick refresher on Mohr's Circle for plane stress? Of course not. But in the event that a friend needed to check these things and countless others, efunda.com would be the place. "The world's number one online engineering resource" offers articles and datasheets, design and process guides, formulas, conversions, calculators, and much, much more.

matweb.com

MatWeb includes metals, alloys, ceramics, semiconductors, fibers and other engineering materials as well as polymers in its 85,000 plus data sheets. You can do quantitative, categorized or keyword searches, and access formulas, calculators and original industry-based content.

scitechdaily.com

For your daily dose of science and technology coverage and analysis, from the practical to the absurd, you can't beat SciTechDaily. For example, you could read about the split linguistic personality of robots, what The Rise of the Planet of the Apes can tell us about brain boosting, and how Queen Hatshepsut of ancient Egypt quite possibly moisturized herself to death with carcinogenic beauty cream.

engineeringsights.org

It's a pleasure to find this family-friendly guide to the "countless sights that tell the engineering story" all over the country. Attractions range from amusement parks to nuclear power plants, and each gets its own page, complete with background info and fun facts.

engineerblogs.org

Like everyone else, engineers like to share. A great way to find out what's on the minds of your fellow professionals, this site offers a broad range of voices and perspectives on topics ranging from Academia and Aerospace to Software and Salary.

universe.lego.com

The perfect opportunity for you and the kids to bond in the epic battle against evil, LEGO Universe is a Massively Multiplayer Online Game (MMOG) that you download free and play alongside other gamers from around the world through a secure game browser. New battles, worlds and missions are added all the time, and a team of live moderators is on hand 24/7 to keep the warfare safe.

It's a whole other Protocultural discussion for another day, but we can't do a web-for-engineers roundup without mentioning at least a couple of our favorite apps and blogs.

ghostwood.org/software/calculator.html
The Engineer's Calculator from Ghostwood turns your iPhone or iPod Touch into an engineering calculator that provides the most commonly used engineering functions, with numbers displayed in engineering notation.

itunes.apple.com/us/app/e-engineer/id328711779?mt=8
The e-ENGineer app for iPhone and iPad provides solutions to a wide range of calculations commonly used in electrical engineering: Volt Drop, Star Delta and Delta Star transformations; Ohm's Law; calculations to resolve V, A, VA, kW, VAr & power factor; capacitance and more.

appbrain.com/app/etools/com.BinarySheep.eTool
The eTools app for Droid devices offers electrical engineers and hobbyists a plethora of helpful features and functions, including resistor tool, LED resistor calculator, and inductive and capacitive reactance calculators.

joelonsoftware.com
In this entertaining and highly informative blog, Joel Spolsky, NYC software developer, has been "ranting about software development, management, business and the internet since 2000." The blog archives offer more than 1,100 articles on everything from The Joel Test: 12 Steps to Better Code, to Martian Headsets.

First Cool Idea!

Winner Brings Relief to the Table

"Completely tasteless."

You couldn't pay Don Ladanyi a nicer compliment. Tastelessness is what his product, the first winner of the Proto Labs Cool Idea! Award, is all about. Proto Labs is awarding up to $100,000 worth of prototyping and short-run production services through its Cool Idea! Award, and Don's innovative product idea secured a portion of the award to help get his product off the ground.

Don's invention, TruFlavorWare®, is a line of eating utensils designed to help make food taste better to people undergoing cancer treatment. One problem cancer patients face at mealtimes is that food flavors are distorted because chemotherapy can cause chemical reactions in the mouth with metal flatware. TruFlavorWare takes that problem off the table. Unlike standard utensils, TruFlavorWare is taste-inert, organic and non-metallic, so it doesn't trigger the bad aftertastes that make it hard to enjoy food.

"Don's taste-inert flatware is a cool idea because it solves a very basic problem—that is, how to neutralize the unpleasant taste caused by standard flatware when your sensitivity to metal or plastic is acute," said Proto Labs founder and CTO Larry Lukis. "With Cool Idea!, we want to stimulate innovation by helping deserving products move past the idea stage to market viability. Toxin-free flatware that restores the dignity of mealtime to cancer patients certainly fits the bill."

Don's inspiration for the product came to him one night at dinner. He was dining with chopsticks and realized that the neutrality of the bamboo heightened the flavor of his food. "It was a revelation to me when I realized that everyday eating utensils actually interfere with what we taste," Don says. "I knew how unpleasant it was trying to eat when all you can taste is metal or plastic, so I wanted to find a better solution. I wanted to create something that would allow a strawberry fruit salad to taste like a pure strawberry fruit salad, not some harsh metallic version of a fruit salad."

In addition to being taste-inert, TruFlavorWare is BPA-free and highly durable, made from a proprietary composite material that has been ergonomically designed and weighted to approximate the substantial feel of traditional flatware. Unlike everyday lightweight plastic flatware, TruFlavorWare is totally dishwasher-safe and lasts a lifetime.

And—key point here—people actually like using it. In an early beta-test at a major Ivy League university, a random panel of 100 tasters preferred TruFlavorWare over regular metal flatware by a resounding 2:1 majority.

Don, a former biomedical engineer based in Westlake, Ohio, is launching the TruFlavorWare line in the Cleveland area, with plans to expand to healthcare facilities across the US—thanks to the Cool Idea! Award. As Don puts it, "I couldn't have done this without Cool Idea!—I'm absolutely dedicated to the success of this product, and am grateful for the prototype and initial production support from Proto Labs."

*For more information on Don's product, visit www.**truflavorware**.com*

*For more information on our Cool Idea! Award program, visit www.**protolabs**.com/coolidea.*

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THE SPEEDWAY

A quick look at what's new from Proto Labs

COOL IDEA! HONORABLE MENTION:

proto labs Cool Idea!™ AWARD

The Cool Idea! Award just got cooler! Due to the high response and strong submissions we've received, we've now added an Honorable Mention category to the Cool Idea! Award. Recipients of an Honorable Mention receive a 25% discount on their order, and like award winners, are considered for promotional exposure. So tell your friends, tell your coworkers, and keep sending those ideas in!

PROTO LABS MAKES THE INC. 5000 LIST:

2011 Inc. 500|5000

Recently, Proto Labs was recognized by Inc. Magazine as the 92nd fastest-growing private manufacturing company in the United States. The Inc. 500/5000 listing is the annual publishing of its exclusive ranking of the nation's fastest-growing private companies. Look for the listing in the September 2011 print issue of Inc., and thanks for playing a role in getting us there!

COOL PARTS, COOL CALENDAR

Designed by designers and engineered for engineers, the Proto Labs Cool Parts Calendar features the visions of product developers across the nation and around the world. The Proto Labs Cool Parts Calendar features real parts from real Proto Labs customers along with part applications, monthly contests, and tradeshow dates, not to mention those elusive days of the week. Request yours while the supply lasts at www.**protolabs**.com/calendar.

SOCIO-PROTO

Hey LinkedIn, Facebook, and Twitter users—Connect with Proto Labs at your favorite social sites and get the latest on what we can do for you (there's more all the time!) as well as design tips, and other newsworthy, educational or otherwise worthwhile stuff. Link, Like, Subscribe and Follow us, and you won't miss out.

www.**linkedin**.com/company/proto-labs
www.**facebook**.com/ProtoLabs
www.**twitter**.com/#!/protolabs
www.**blog**.protolabs.com

VIDEO DESIGN TIPS

Bosses! Bump-Offs! Bayonet Mounts—and so many more! Check out the Protomold video design tips featuring Proto Labs' own design star Kevin Crystal. And if you'd like to subscribe, you'll be notified you as soon as a new video has been posted. www.**youtube**.com/user/ProtoLabsInc

Join the discussion!

Email article ideas, cool projects or great design stories to the editor at stacy.sullivan@protolabs.com.