by Don Lancaster

Engineering Ratholes

There sure seems to be an awful lot of really bad engineering coming down lately. Such as a short range missile that uses many *dozens* of slip rings. Or a zillion dollar remote infrared sensing system which replaces a penny's worth of temperature sensitive paint. A solar panel that generates electricity solely to *resistively* heat water! All to avoid a thirty cent drain valve.

A new "ultra efficient" engine. That seemingly avoids a minor motion conversion *non*-problem. While introducing insulated liquid sodium, magnetohydrodynamics, costly magnetic bearings, and incredibly complex electrics.

Charging Madness

Or get this: An expensive and high profile ad campaign. Shows a ridiculously overdressed female. Standing beside a gas pump shaped power source. Holding a gas hose shaped cable. Plugging a gas nozzle shaped connector into her electric car. What is wrong with this picture?

Well, electric vehicles *will* autocharge. Unattended and contactless. From below. Not only is human intervention totally unneeded, it is quite costly, unsafe, inconvenient, and time wasting to do so.

Even the very concept of going someplace "special" to recharge your car does not make any sense at all. Card operated charging stations will end up *everywhere*. Every parking lot will have several. About the only place you'd be *unlikely* to find one is at a gas station.

U-turn Insanity

It seems someone has patented a "U-turn" indicator for cars. Whenever you want to make a U-turn, you'll flip a special switch which progressively lights up a large rear pointing arrow.

Which gets me to thinking: How often does the average driver make a U-turn? How many people genuinely and truly care about telling the traffic behind them every time they make a U-turn? What percentage of the time will they do so? What is the amortized *per-turn* cost?

What is its investment payback period?

More importantly: When a random and unknown driver is presented with unexpected and confusing inputs during a high stress situation, will accidents *increase* or *decrease*?

What are the consequences of one litigious driver?

Now, I do not want to prejudge the answers to all these questions. U-turn indicators could see a groundswill of popular demand that rockets them into becoming the killer ap of the millenium. But your key point is that all these questions should have been asked – *and answered* – very early in the product development cycle.

The patent, of course, is utterly worthless. It describes something completely obvious to any practictioner in the field. Worse, if such a device were really built, it would be as a *generic* icon display system, capable of *any* message or symbol. Rendering all patent claims moot.

The Ratholes

One way to avoid bad engineering is to stay away from energy sinks into which bunches of time and money have previously been dumped with no visible effect. I like to call these *engineering ratholes*. Let's look at a few of the more popular examples coming over my voice helpline...

Thermoelectric coolers– The solid state *Peltier* coolers are certainly useful. When only *tiny* amounts of heat need be moved from point A to point B. But there is an absolute brick wall around eight watts or so. These devices are ludicrously inefficient. Often, five watts of heat have to be dumped to provide one watt or less of cooling. At high power, this causes your heatsink *rise* above ambient to *exceed* your net device cooling drop! (HACK68.PDF)

Stirling engines– Every few years somebody rediscovers the Stirling engine. They build a few prototypes which just barely fail to work, and then just barely go bankrupt. The promise here sure is enticing. A low delta-T engine which accepts anything from oily rags to sunlight.

But there's two fundamental gotchas here. First, *any* engine designed for a low ΔT temperature differential is *inherently* inefficient. Carnot and all. More crucially, there is a key component to a Stirling engine that nobody – but nobody – has figured out how to build yet. It is called a *regenerator*. Any regenerator has to be long and thin and short and fat. Not to mention being an excellent insulator and a superb conductor. (HACK64.PDF)

Subsurface radar – It is extremely difficult to couple any electromagnetic signal in to or out of the ground. Firstoff because of direct losses. Second because of severe coupling mismatch at the earth-air interface. And third because water has an enormously high dielectric constant. As a result, your effective ranges will *always* be ridiculously shorter than you'd first suspect.

Any "treasure finder" that claims a penetration greater than its length or whose resolution is less than one-tenth its sensor head size is highly suspect.

Hall compasses– Low cost sensors based upon the *Hall Effect* are really great for use as position pickoffs, current monitors, or similar aps involving *strong* magnetic fields. But these are a *thousand times* too insensitive to be useful as a quality electronic compass.

Instead, *the* solution to low cost earth magnetometry is called the *fluxgate*. A saturated mag core with several windings. Been around for sixty years now, and still works like a champ. It ain't broke. (RESBN37.PDF)

Anything automotive– Sorry, kiddies, but this one is a closed club. Unless you are a SAE member, your father is a senior member, and your grandfather is a fellow emeritus, forget it. What's even worse is that all major players are dramatically *reducing* the number of their suppliers. And outsourcing engineering *only* to proven firms.

High power piezo– There are all sorts of wonderful new micropower aps for piezo stuff. Especially the great new materials from *Amp Kynar Piezo*. But except for a few resonant ultrasonic transducers, high power piezo seems doomed to failure. Indeed, every attempt at doing a motor or a stepper or a positioner beyond a one watt power level has been a commercial disaster.

The prospects for high level piezo power production are even more grim. Unlike a conventional "H-field" generator which produces a current through a conductor, piezo is an "E-field" machine which generates its voltage across an insulator. Guaranteeing an abysmal power density.

Qwerty vs Dvorak– The Qwerty keyboard was specifically designed to *slow typists down*. It has been one of the most ergonometrically absurd designs of all time. But this one is so deeply culturally ingrained that *any* attempt to replace it is *guaranteed* to fail. You might bend it a little. Literally.

Or add a mouse substitute. Or argue over where to put the escape key. But *no way* are you going to replace it.

Proof of Qwerty's intractability? Most Apple computers let you instantly switch to a more egronometric Dvorak key arrangement with a mouse click or two. Just try and find anybody anywhere who *ever* uses this feature.

Cold fusion– Died stillborn. Not only is their horse gone, but the barn door burned down and the entire farm is now a vacation condo. Pathological science at its bizarre worst.

Tesla stuff–Tesla was certainly one of the finest engineers of all time. Who developed both the induction motor and polyphase ac transmission. But he also was one of the greatest con artists this side of P.T. Barnum. And clearly was a few chips shy of a full board. There's a latter day cult built up around Tesla's "free energy" schemes.

Which flat out ain't gonna happen. (RESBN18.PDF)

Other pseudoscience – If you've slept through Physics 101, the three laws of thermodynamics are: You can't win. You can't break even. And yeah, the dice are cooked, but it is the *only* game in town. Every attempt at perpetual motion to date has failed miserably. And virtually every other pseudoscience topic so far falls apart when given close enough scrutiny.

For a wondrously wacky tour of beyond the bizarre, check into the *KeelyNet*. For a sanity check, go instead to the *Skeptical Inquirer*. (RESBN26.PDF)

Fuzzy logic and neural nets– I sure enjoy watching Bob Pease slam these over in *Electronic Design*. Apparently, there *never* has been a real world Fuzzy Logic or Neural Net ap anytime ever that was even *remotely* as good as a well thought out traditional solution. To me, the whole field appears to be a huge smoke and mirrors scam.

Two key problems are that the math gets super ugly as the number of allowable conditions go up. And that most proponents simply do not have the vaguest clue as to how a real world ap has to perform.

Avoiding Bad Engineering

How can you personally avoid doing bad engineering? Here's some guidelines that may be of help...

Get and stay informed– Be sure you *thoroughly* understand the fundamental underpinnings of your target field. Don't write a forest fire simulation if you've never sharpened a *Pulaski*. The best and cheapest way to get informed is with all those zillions of free trade journals listed online in the *Oxbridge Media Finder*.

Get the necessary tools– It never ceases to amaze me how many callers are trying to repair a tv or interface a monitor without using an oscilloscope. Or how many are still doing old line analog designs. When digital has done the task faster, cheaper, and more flexibly for well over a decade now. It is unthinkable to research astronomy without a telescope and a computer. The same fundamental tool need applies for *all* technical ventures.

Ask who has gone before you– Your concept is *not* new. Others are *certain* to have plowed this ground before. Who were they? What did they say where? What do you know that they don't? By far your most cost effective tool to find published info is to...

Use online services aggressively– Experts in *all* fields are a few modem bytes away. From the Internet, commercial BBS services, or local labor-of-love setups. It it *totally unthinkable* to attempt *any* technical venture today without tapping these incredible resources.

Your simplest Internet access these days is often by way of a local or regional ISP.

Avoid the momentum trap– Your initial designs *will* be wrong and *will* have to be modified. Every time. For the "real" problems do not appear until well into beta test. If you do all your work *knowing* that changes are *inevitable*, then you are less likely to lock in a lousy design.

Beware the gotcha, my son– There is not much point in working on a concept that goes head on against a Fortune 500 company. Or is in a field that abhors innovation. Or goes against the cultural grain. Or is legislated to death. Or has strong alternates. Or a narrow pre-obsolescence market window. Or invites costly litigation. Or has no buyers.

Don't be overly enameled of your ideas– If you are *very* lucky, one of your concepts in *five hundred* might end up a commercial success. Ideas are worth ten cents a bale in ten bale lots. Since most of your ideas are *guaranteed* to fail, it will pay to ruthlessly get rid of them just as *soon* as you possibly can. Stomp them out.

RATHOLE AVOIDANCE RESOURCES

America On-Line
8619 Westwood Cntr Dr
Vienna VA 22182
(800) 827-6364

Amp Kynar Piezo
Box 799
Valley Forge, PA 19482
(610) 666-3500

CompuServe
5000 Arlington Center Blvd
Columbus OH 43220
(800) 848-8199

Dialog Information Svcs
3460 Hillview Ave
Palo Alto CA 94304
(415) 858-2700

Electronic Design
611 Rt #46 W
Hasbrouck Hts NJ 07604
(201) 393-6060

GEnie
401 N Washington St
Rockville MD 20850
(800) 638-9636

KeelyNet BBS
Box 1031
Mesquite TX 75149
(214) 324-3501 BBS

Skeptical Inquirer
PO Box 703
Buffalo NY 14226
(716) 636-1425

Synergetics
Box 809
Thatcher AZ 85552
(520) 428-4073

Ulrichs Dictionary
121 Chanlon Rd
New Providence NJ 07974
(908) 771-7714

No patents!– Patents are a totally unneeded sideshow. One which is virtually *certain* to make your concept fail. Focus your time and energy on developing and improving your product instead. Rather than fruitlessly chasing mythical "protection". (WHEN2PAT.PDF & PATNTHOR.PDF)

Shun paranoid secrecy– Working by yourself in the dark is a sure fire formula for failure. The only reason to keep an idea or a concept a total secret is that it is so awful that you'd be embarassed to tell anyone about it.

Run a reality check– Who cares about your product? What need does it fulfill? Who would buy it? One sure test is to locate *five* people who will agree *in writing* to buy your product. More importantly, who gets really upset over your design? Does it confront the big boys head on?

For more help

Needless to say, any rathole can become an enormous opportunity. But only *after* you do thoroughly understand what went before. And only *when* you can bring something truly and genuinely new to the table.

Much more on all of these concepts shows up in my *Incredible Secret Money Machine II* and in my *Resource Bin* and *Blatant Opportunist* reprints. All of the mentioned filenames and continuing support on these topics appear on my *Guru's Lair* website at *www.tinaja.com*.

UPDATE: I've left the original names and numbers for historical accuracy. Newer and better resources are found at *www.tinaja.com/webwb01.html*

Microcomputer pioneer and guru Don Lancaster is the author of 35 books and countless articles. Don maintains a US technical helpline you'll find at (520) 428-4073, besides offering all his own books, reprints and consulting services.

Don has catalogs at www.tinaja.com/synlib01.html and at www.tinaja.com/barg01.html

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