Don Lancaster's

RESOURCE BIN

number twenty-five

Essential homebrew test equipment.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 MST. I've got a free pair of insider secret resources brochures waiting for you when you call or write.

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This month, I'd thought we might take a close look at what is and is not useful in the area of electronic test equipment. Let's start off with...

Neon Test Lamps

At one time, this was by far your most important piece of homebrew test gear. I'll still call it number one because of its cost and utility.

A neon test lamp lights to verify the presence of higher voltages. Which is great to find out whether 110 volt ac power is connected, or for any quick check of primary fuses, switches, line cords and such.

Hint: If you place your neon tester *across* a fuse in a powered circuit, the lamp will *light* if the fuse is *blown*, and vice versa. Similarly, the lamp lights on any *open* switch and does nothing on a closed one.

Another tip: Some older electronic gear (especially tube table radios) tied one side of their chassis to the power line. Which can create a deadly shock hazard for the unwary. Simply hold on to one terminal of your neon tester and touch the other one to the chassis. If the lamp dimly lights, you've got a hot chassis.

Multimeters

The second most important piece of homebrew test gear is some method to measure ac or dc voltage, current, or resistance. The traditional way to do this is with any meter-style VOM *analog multimeter*. The newer way is to use a DMM or *digital multimeter*.

Yeah, digital multimeters are more accurate and load your circuits a lot less. And they don't really cost that much more. But I still feel you should start off with a plain Jane analog VOM instead. Analog can put you closer to what you're actually doing. The meter pointer position is more ergometric. And there's fewer rude surprises in not really measuring what you think you are. Especially at first.

NEXT MONTH: Don looks at ongoing happenings in the pseudoscience industry.

At any rate, the heart of any analog multimeter is a microammeter. To measure higher currents, a low value *shunt* resistor gets placed *across* the meter. This shunt diverts most of the current and thus multiplies the meter reading. Any perfect ammeter should offer a *zero* resistance to your outside circuit under test.

To measure voltage, a high value resistor gets placed in *series* with the meter terminals. This resistor makes use of Ohm's law to convert voltage to a current. The microammeter then measures your current. A voltmeter should present a very *high* resistance to your circuit. Ideally infinite.

It's just not possible for you to *ever* measure *anything* without disturbing what is being measured. For even if you could reduce any power removed from your test to a bare minimum, the very fact that information is getting extracted from an environment means that the entropy is unavoidably getting altered. Thus, *all* measuring systems *must* in some manner both disturb and distort what's being measured.

The trick is to make your errors as low as possible. Traditional analog multimeters are usually said to have a voltmeter sensitivity of so many *Ohms per volt*. One popular value here is 50,000 Ohms per volt.

To find the actual loading on any scale, you multiply the Ohms per volt times your *full scale* setting selected. Ferinstance, if you are on a 5 volt DC range and have a 50,000 Ohms per volt sensitivity, you'll end up with a resistance of 250,000 Ohms loading your circuit being measured.

The loading of analog multimeters was first eased by going to external amplifiers, first as VTVM's, and later as FET voltmeters. Typical premium multimeter circuits include amplifiers that produce extremely light circuit loading. A fixed value of 10 megohms or higher is common.

Resistance is usually measured by setting a current and then measuring the voltage drop that current creates in your resistor being tested. Older

multimeters applied a battery and a series resistor to give you the needed current. This is why the Ohms scales are so cramped on many meters. By the way, the series resistance will be the resistance value at the *exact middle* of the scale being used.

The currents used to measure low Ohms can end up quite high. So high that they can cause damage. A good rule is to *never test a solid state device on the lowest Ohms scale!*

Always use the next higher range.

Better multimeters use true current sources and internal amplification to linearly measure the resistance values. This ends up safer and much lower in power. For low resistances, brief pulse techniques get used.

Once again, I suggest you start off with an analog multimeter. You can always add a DMM later as the need arises. Avoid the junkiest of low end meters since they are both inaccurate and rather unpleasant to use. Those medium quality ones from *Radio Shack* (such as a #22-214) seem a good deal, especially when they go on sale.

My first choice in an analog meter is still that good old *Triplett 310*. This one is quite compact and has lots of accessories such as belt pouches and clamp-on-ammeters.

Power Supplies

Next, you will need several power supplies for your experiments. Most digital projects need +5 volts dc. But the latest designs are now moving on down to 3.3 volts. Those older analog op-amp projects typically used a pair of supplies of +12 and -12 volts.

Any test power source should be *regulated*, meaning that it tightly holds a fixed or selected voltage output. It should also be *current limited*, so it can both protect itself from output shorts and prevent damage to your project that is under test.

Even fancier is the *foldback limiting* that snaps down to a very low current value on any overload.

I'd start out with a fixed 5 volt, 3 amp dc supply, along with a pair of positive and negative supplies that could get varied from 0-15 volts or higher. Then add some heavier stuff, say an auto battery fast charger. Or, for ac work, a variac and an isolation transformer. At least 300 watts.

The simplest and cheapest way to get started here is with those plug-in wall mount supplies. Offered by the zillions right here in *Nuts & Volts* ads. While simple and cheap, these do lack adjustments or meters that let you see your current being used.

Be sure to read all the fine print on these. Some are simply transformers. Some are unregulated. And others do offer full regulation. Very few can be used beyond their ratings.

For quick and dirty work, several plain old batteries can be handy. Only these are not at all regulated and not protected against overloads. They also run down when you least want them to. *Maxim* does sell some interesting regulator kits that work well with low voltage battery supplies.

Do not forget that a shorted Nicad battery can explode!

Another ploy is to combine a plastic case with several power supplies and a breadboarding area. Again, you'll find ads for these here in *Nuts & Volts*. Your classic supplier for this sort of thing, of course, is *Heathkit*. Who do continue to supply these and similar industrial education products. By the way, one great source for precut wires is *Squires Electronics*.

An Oscilloscope

A decent oscilloscope is *absolutely essential* for more serious electronic work. A scope lets you see the actual waveforms as they happen.

In its most common setup, a scope graphically plots one or more varying voltages vertically, while showing time along its horizontal axis. You can usually change the time scale from tens of seconds clear down to tens of nanoseconds. Your viewed waveform will usually be a mix of your desired signal and a circuit bias level. Choices of AC or DC coupling are offered.

To make a stable display, the scope timing gets *synchronized* to something by using its *triggered* sweep. In this case, the sync source can be the signal itself, some other signal, an external input, the power line, or a tv frame or line reference. Scopes usually offer auto-triggering so you always have a display. But note that auto-triggering should definitely *not* be used when viewing very slow waveforms.

There are other less popular, but equally useful, ways of arranging an oscilloscope's display. For instance, you can display one signal on the X axis against a second signal on the Y axis. You might do this to run tests on circuit elements, or to curvetrace the responses of solid state devices. Or just to measure audio phase shifts or distortion. Or to view color tv chroma vectors. Or (very rarely anymore) for

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use as stroked vector graphics.

You can also scan your oscilloscope at a fixed rate and then modulate the brightness, producing video in pretty much the same way you would a tv or personal computer monitor display. Brightness (or "Z-axis") modulation is also used for emphasis of portions of waveforms. Especially when using any sweep delay features.

Finally, you can plot Y amplitude versus X frequency for a spectrum analyzer. Or do really weird stuff like Smith Charts or quadrature art.

As with multimeters, there are two different types of scopes today. These are traditional *analog scopes* and *digital storage oscilloscopes*. With an analog scope, what you see is what you get – a real-time picture of what is coming down. With a digital scope, the input gets A/D converted and stored into a computer's memory.

Analog scopes remain the best for high frequency work. But a digital scope has several advantages. Firstoff, it lets you use a much cheaper and simpler CRT video display. Hard copy output and data acquisition is greatly simplified. Digital storage scopes also can easily let you view *negative time* events which took place *before* your trigger point, simply by looking back at stuff previously stored.

On the other hand, many digital scopes are limited to low frequencies and to sampled data intervals. Thus crucial glitches and such can be easily missed. A big problem.

I do think I'd still recommend an analog scope as your first instrument. Normally, you will ask for a vertical frequency response of 50 Megahertz. And much more for serious rf work. At least two vertical channels. Usually you'll have your choice of *alternate* sweeps where you rapidly view one and then the other, or *chopped* sweeps where your scope can quickly switch between the two channels.

Generally you use chopped sweeps for lower frequencies. Note that when you use alternate sweep, you are *not* comparing identical waveforms. One is *always* behind the other, The exact phasing will be unknown.

Two important scope features that confuse newcomers are *vertical delay* and *sweep delay*. On any decent analog scope, a delay line gets added to the vertical channel, so that *you can view the waveform that you just triggered on*. Your triggered sweep thus will start running before the signal arrives.

Sweep delay is totally different. Say you want to examine a detail in the middle of your waveform. Perhaps a chosen line of mid-screen video.

Instead of triggering your sweep by using your main sync circuit, you'll instead start a precision time delay. At the end of that time delay, you start your actual sweep. This can let you expand a complex waveform so you can inspect a tiny detail.

Usually you'll have your choice of starting the sweep after the delay, or else resynchronizing to some other internal or external event.

There's a simpler and cheaper way to do this that is called *magnification*. All magnification does is make your sweep ten times wider than it was and lets you view any tenth of it. While certainly useful, magnification is not as powerful as sweep delay.

Ah yes. Scope probes. If you just hook up any old cable between your scope and your circuit, the cable and scope input might load your circuit badly. Instead, special *scope probes* are normally used. Your most popular probe offers a 10X attenuation as a tradeoff to limit circuit loading.

VERY IMPORTANT: Scope probes *must* always be carefully matched to *one* particular scope input at any one time. You cannot simply grab any old probe and then glomp it onto just any old scope input. If you try this, your probe will lie like a rug.

Instead, you will have to carefully *calibrate* the response of your probe to match that of the scope. Calibration is simple and easy to do. There'll be some test waveform jack somewhere on the scope. You can then adjust a trimmer or twist the probe barrel until square waves end up as truly square without any distortion.

Never change a scope probe without recalibrating it! Don't even think of it. It is also extremely important to use the shortest possible ground wire lead directly at your scope probe. Fail to do this, and you are *certain* to create all sorts of on-screen artifacts.

You'll find lots of different probes and accessories. There are 1X probes for any direct small signal work that demands higher sensitivities (watch the loading on these!), high voltage 100X or even 1000X probes, and lots of specialized stuff to directly access rf or ultra-tiny circuits.

Which Scope?

I very strongly feel that there are only three brands of oscilloscope you should *ever* consider using under *any* circumstances: *Tektronix*, *Tektronix*, or *Tektronix*. Anything else is pretty near guaranteed to cause you more trouble than it is worth.

Above all, don't get sucked into any of those truly ancient *Heath, EICO,* or *DuMont* scopes. These scopes all lack *everything*. They lack a dc response, a decent bandwidth, a triggered sweep, or the ability to measure time.

These scopes are totally useless and have *zero* value. Except to a collector. If you find one of these for $7.50 at a hamfest, you are being ripped off.

Tektronix does offer one excellent *XYZ's of Using an Oscilloscope* student manual, along with some fine videos.

These are usually free in singles.

Yeah, Tek scopes are expensive. But cost and value end up as two totally different things. And today, they offer ridiculously more bang-for-the-buck than they once did.

As I see it, there are three different routes towards getting yourself a real Tek scope. You can go new or nearly new, select a middle-aged 565, or go to a classic Tek boat anchor.

Tek's newest instruments are very cost effective. So your first method is to simply bite the bullet and go get yourself a new one. They offer a low end 2205 at $700 list or so, but their best buys appear to be their TAS455 analog or their 2212 combined analog and digital beastie.

One step down from new Tek, see if you can't find a used 2235A analog or a 2201 combo. These are ideal student lab scopes, and can be an outstanding choice for everyday uses.

The all-time *numero uno* Tek scope was the 565. At one time found wall-to-wall at any aerospace shop. These are fairly compact and only painfully heavy. These workhorses offer solid state circuits, 65 Mhz bandwidth, dual channel, vertical and sweep delay.

Thus, your second choice in a Tek scope should be a used 565.

These are rapidly being dumped to surplus markets. Because of the big aerospace dryup, community colleges stupidly cancelling their electronics programs, and a lack of demand from leasing houses.

You should find lots of these right here in *Nuts & Volts* or at any hamfest. I'd guess a good street price would be around $600, but I'd be suspicious of anything much lower than that.

My own scope is still Tek's old 455 plastic version of their 565. Allowing for inflation, I paid around five times what a lot more scope costs today.

Your third option is to go for one of those classic Tek boat anchors. These vacuum tube instruments end up both unbelievably heavy and humongous. They'll normally sit on a private scope cart rather than your bench. They can totally dominate your work area.

Because of their size and weight, the popularity and the street prices of these instruments has really dropped. Yet a properly calibrated unit is now and always was a first rate scope. On the other hand, certain parts may be virtually impossible to get.

There is a brand new resource that makes these older beasties worth a new look. *Stan Griffiths* has written an *Oscilloscopes: Selecting and Restoring a Classic*. Stan also offers user support in the way of tech info and parts.

I'd guess that a Tek 545 for around $165 and with a dual trace plug in for $40 or so might be a good buy. Watch your shipping charges on these.

Be sure to try for cash-and-carry.

These older scopes are also seeing new interest as collectibles.

Scope Cards?

There is also yet another interesting option emerging: Using plug-in cards on personal computers to substitute for a digital oscilloscope. Many units have been offered, but so far there is no really clear cut winner.

One obvious problem here is that the market is so new and fragmented that the costs are still out of line. A second is that you might have other things you want to use your computer for at the same time you are testing waveforms. And a third is potential problems with the system noise and ground loops in most computers. And a fourth is that we still don't have any cheap and fast A/D converters.

Then again, traditional scopes have real hassles with storage, hard copy, or comm of measured waveforms. But these get solved in one swell foop if you are computer based.

At any rate, several quality sources of instrumentation plug-ins include *National Instruments*, *Keithley*, *Data Translation*, those *Industrial Computer* folks, *Pro-Log*, or *Computer Boards*.

Let me know your experiences with these types of products.

A Programmable Microcontroller

What next? A few years back, I'd pick something like a logic probe, a function generator or a counter as next in line after a scope. But no more. These days, you simply *must* have a new programmable microcontroller on hand and immediately available to do anything you ask of it.

No matter what your project, if you do omit your microcontroller, you are almost certain to (A) raise its cost, (B) sharply reduce its performance, and (C) make it insanely harder for you to do your design and debug.

Similarly, mockups and simulations on personal computers can greatly reduce your development costs.

Thus, you *always* want to go out of your way to *include* a microcontroller in all your projects. To not do so these days is sheer folly.

Ferinstance, you want to develop some caller-id projects and the service is not yet available in your area. A few minutes using a microcontroller or a personal computer, and you have a complete suite of test signals all ready to go. Or otherwise are able to grab, save, display, print, or communicate measured data.

Naturally, the more familiar you are with machine language and other "bare metal" techniques, the more a microcontroller can do for you.

Once again, if you are not using a microcontoller, you'll end up doing something the hard way. And costing you time, money, and market share.

I'll leave it up to you just how you handle this. But the key point is to always keep *something* handy that can immediately be programmed to do useful stuff for you.

Your most obvious selection here would be a $30 Commodore 64 from a yard sale or hamfest. An older Apple II+ or (better yet) a IIe can also be an excellent choice. I have still got a few old KIM-1's left over from way back when, so these are my usual choice for dedicated lashups.

Another possibility is the great $30 *Basic Stamp* from *Parallax*. Or any of the many microcontroller projects that appear in *Circuit Cellar Ink*.

This Month's Contest

For this month's contest, just tell me about an unusual and cost effective piece of test equipment that you have found handy for homebrew work.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free brochure full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

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You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552.

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I have long been fascinated with *pseudoscience.* The ongoing "technical" developments that the Houyhnhnms would have very politely called "that which is not so". Things like perpetual motion, zero point scalar energy, 400 MPG carburetors, the earth resonance power, antigravity, dowsing, UFO's, instant AIDS and cancer cures, happy face crop circles, Orgone blankets, the area 51 enigmas, telepathy, the Tesla mania, magnet motors, channelling, or even antimatter propulsion.

Usually with an excessive dose of conspiracy and paranoia thrown in.

It turns out there is a rather well developed pseudoscience *industry*. It is made up of a number of individuals and smaller firms which offer a wide range of fascinating products. So, this month I thought we'd look at some of the major players here. And see just what they have to offer.

I do *like* pseudoscience for several reasons. First, pseudoscience fiction can be a wondrously bizarre read. Or superbly entertaining. Second, open forums definitely should exist for all controversial or oddball thoughts.

Third, most pseudoscience gives us mesermizingly awful samples of how *not* to do research, how *not* to desktop publish and how *not* to technically communicate.

Fourth, some of the weirdest and even dead wrong concepts sometimes may have the germ of a useful idea in them. Or simply some fresh way of looking at the world. Yeah, this is a needle-in-the-haystack type of thing. But it sure is fun to look at. And hope does spring eternal.

And finally, lots of pseudoscience demands an aura of "mystery" and "supression" and "lone underdog" or "lost technology" or similar hogwash.

NEXT MONTH: Don looks at opportunities and resources for servicing electronics.

If we gather up all the pseudoscience info, stack it together on center stage, and shine a bright light on it, many people just might end up concluding "Yup, that's a big pile all right."

Now, I come to all of this from a traditional engineering background. I strongly believe in the experimental scientific method and in all the laws of thermodynamics. I also believe that observed effects can get measured in one manner or another; that low loss action at a distance is extremely rare; that statistical laws for large numbers are to be believed in; and that, more often than not, lab measurements end up just plain wrong.

Or not even wrong.

But I would also freely admit that science *is* a religion just like any other. And that any establishment certainly tends to villify anything which looks even remotely threatening.

Paraphrased, your thermodynamic laws are (A) You cannot win, (B) You cannot break even; and (C) Sure, the dice are crooked, but this is the only game in town.

There are simple tests you can use to quickly separate real science from pseudoscience. The *objective* test asks two questions: "Is there some simple experiment which some disinterested third party might perform which will make their claimed effect show up?" Along with "Are the claims the most reasonable and logical explanation for the observed effects?"

I also use *subjective* pseudoscience filters. Does it like water, look like a duck, quack like a duck? Is it about to lay some eggs?

In mild cases, I use a "Tain't likely McGee" test. For medium severity, a "Boy, a whole flock of 'em flew over that time" measure. And for really far off pseudoscience, there's always the "What are they on, and where can we get some of it?" ploy.

Some pseudoscience is an outright scam. Other variants are hoaxes that got out of hand. Yet others are urban folklore. Pseudoscience often results when the lab work is missing, poorly done, or just plain wrong.

Ferinstance, say you build a motors and magnets style perpetual motion machine and connect it to the 110 volt ac power line. You then measure the current at 5 amperes. What is the real

power being consumed?

Well, there is no way to tell with the information I just gave you. But you can safely bet the answer is nowhere near 550 watts.

Citations and *peer review* both form important parts of real science. Does the new development build on what already has been studied and learned?

Do others feel that what is coming down is reasonable and verifiable?

Much of pseudoscience does appear to choose slow-day stories in rather obscure rural newspapers for all their primary references. Or else will badly misquote seemingly authentic real papers and researchers.

As anywhere, interesting patterns emerge when you *follow the cash flow*. Who benefits and why? Which egos are reinforced? Which magazines get sold? Who goes on tv? Who gets the attention? Who gets paid?

Let's take a look at who is offering what these days...

Rex Research

Robert Nelson is a researcher up in Jean, Nevada. Who has now carefully gathered together scads of reprints on pseudoscience, weird science, oddball technology, and similar off-the-wall topics. He filters and assembles these into *Infolios* available by way of his *Rex Research* tech venture.

The typical Infolio covers a subject such as anti-gravity, magnet motors, free energy generators, Tesla, Hall devices, vortex coolers, or whatever. The collection will usually include a few tech papers, some patent copies, and the related news stories. Costs are typically in the $6 to $12 range.

To keep the costs down, the Infolios are simply unbound Xerox copies that are stapled together.

While there are several copy-of-a-copy legibility problems, the service can often be your fastest and cheapest way to pick up background on hard to research nontraditional topics.

Untapped Technology In Review

Here is a brand new magazine out of Mesa, Arizona. This straddles the boundary between pseudoscience and real technology. Real technology that, for one reason or another, hasn't yet seen the light of day. They try to keep a semblance of scientific objectivity while treating pseudoscience and real science on an equal footing.

They are also strong in abstracting unusual energy related patents and in reviewing obscure books.

Why doesn't some real technology see the light of day? Often because of the hidden gotchas.

Such as embrittlement in hydrogen power. Or those commutation hassles over ultra high currents in homopolar generators. Or that need in a Stirling engine for a regenerator that is short and fat. *And* is long and thin. Or that intolerably poor efficiency for higher power thermoelectric coolers.

Borderland Research

This is one of the oldest members of the pseudoscience establishment. For many years they have published their *Journal of Borderlands Research*. This one is a bizarre mix of pseudoscience and new age topics, covering healing energy, alien communications, brain waves, perpetual motion machines, and nether world channeling. Along with heaping bunches more.

They also have an extensive direct mail bookstore that carries hundreds of pseudoscience, Tesla, and new age titles. Many of them difficult to find elsewhere.

Colorado Highs

High Energy Enterprises is a group of related Colorado services. They offer a direct mail bookstore having many titles involving Tesla, free energy, or perpetual motion. They run a walk-in Tesla Museum. And they maintain a foundation or two. They also put on yearly conferences. Tesla in one year, free energy the next. Reprints are also published and stocked.

Apparently, there are some really high spirited pseudoscience people in central Colorado. One spinoff here is that *International Association for New Science*. These folks do run an annual *International New Energy Symposium* and publish thick sets of conference reprints. Typical subjects include zero point energy, cancer cures, the Reed magnetic motors, new electrogravitic propulsion, element transmutation, or vortex extraction.

Two similar groups elsewhere are California's *Tesla Bookstore* and that *Planetary Association for Clean Energy* in Canada. And there are a few more where these came from.

Phaedra Enterprises

David Blevins has just reissued the third printing of his *Almanac of UFO Organizations & Publications*. This one is offered by *Phaedra Enterprises*. It's a combined *Michelin Guide* and *Thomas Registry* to the *UFO* industry.

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Untapped Tech Review
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Mesa, AZ 85211

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Chicago, IL 60680
(312) 431-6102

Listed are many hundreds of UFO resources. These include lots of clubs, clipping services, videos, bookstores, magazines, newsletters, and the other publications.

Even services that are provided by the aliens themselves!

Popular topics these days seem to include the extraterrestrial technology our government has stashed away in Nevada's Area 51, those Swiss UFO photographs, crop circles, channeling, cattle mutilations, contactees, and antimatter propulsion.

It's really unlikely that you will see spacecraft antimatter propulsion any time soon. Although there was one incident just last week when an Italian restaurant exploded when they put the pasta and their antipasta on the same plate.

Skeptical Enquirer

This quarterly journal attempts to debunk pseudoscience and offbeat science topics. It is written mainly by name brand mainstream science and technical authors. Aided by a first rate stage magician or two.

They recently successfully rebuffed a major liability lawsuit from a world class spoon bending mentalist. They also thoroughly trashed that MJIC-12 document which proportedly showed where the government was hiding the aliens they salvaged from the Roswell flying saucer demolition derby.

It appears the key signature came from the Harry Truman library. They even could tell which Xerox machine got used by measuring the percentage reduction. The fact that the document was typed on a machine that did not exist until over twelve years later did not help the cause much.

Alternate Medicine

I'm hesitant to include sources for any highly questionable medical info in a popular publication. On the other hand, some of what was yesterday's quackery becomes tomorrow's clinical procedures. It has become painfully obvious to me that some of the most horrendously inexcusable quackery of all time is now coming from *within* the medical establishment.

After studying on this topic for a while, I've concluded that (A) Many medical problems are your own dumb fault and are either directly caused by or made worse by lifestyle, excercise, emotional, and nutritional factors. (B) A patient that wants to get better and thinks they are taking positive steps towards that end is more likely to do so. (C) Without exception *all* medical personnel have a hidden agenda that might not be in your best interests.

And, (D) Accurate information *from multiple sources* is the key to solving most medical problems.

In particular, I have found that the *Dialog Information Service* gives you the latest and best medical info from exactly the same sources the medical pros use. Your goal here should be to explore options that let you become a more fully informed patient. Dialog can be reached via *GEnie* or through your local library.

The following pair of resources are provided for your needs as a serious pseudoscience researcher and are *not* in any manner intended for anyone seeking an instant cure for anything: One resource for highly questionable medical stuff is *Lor'd Industries*. A second is *Super Science* who is big into *Rife Resonators, Orgone Blankets*, and new methods to *electronically amplify your telepathic communications*. Run by, of all people, Klark Kent.

More Miles Per Gallon

Miracle carburetors have beguiled the public for generations. Needless to say, there has been an awful lot of legitimate research into improved gas mileage. It's real unlikely that instant miracle fixes that use nothing but cow magnets or similar low tech parts are going to work out very well.

A unique source for pseudoscience improved mileage stuff these days is **H & A** *Industries*. Plus, of course, the usual items from *J. C. Whitney*.

Something really cute did happen once over one super mileage product that is worth repeating. Long ago, an "obvious" scam offered to sell "magic tablets" that let you run your car on water. Just drop a few of these tablets into a gallon of water and drive away. Well, yes, it was a scam. And yes, all those establishment scientific people insisted it was *absolutely impossible* for it to ever work.

The only little kicker here is that these tablets were real! Yup, there are definitely magic tablets you can drop into a gallon of water and then power an internal combustion engine using them. Er, there were a few tiny side effects like only getting 200 miles per *engine* instead of 200 miles per gallon. And their economics were not all that great. But let us not quibble. There really are drop-in tablets that convert tap water into a motor fuel.

So much for the experts. And yes, you can still buy these. Fairly cheap too. Ask any caver for details.

Opportunities Passed By

There certainly are more technical nooks and crannies to explore these days. My own feelings are "Why get involved with pseudoscience when so much more happens so much better if you use real science instead?"

Beyond, of course, pseudoscience's superb entertainment value.

If you want to accomplish anything positive, the odds are overwhelming that you'll do better by staying within the laws of physical science. And use

the scientific goals of experiments that can be duplicated, that have credible explanations, and that include careful research of previous work.

If there was a simple and easy way to beat all those thermodynamic laws, beginning power lab students would have found it years ago. If there was something weird coming down with Tesla coils, this should have become apparent to all those EHV power line experiments and to those color tv set horizontal oscillator designers a long, long time ago.

Every obvious connection of motors and magnets and coils has now gotten explored a zillion times over. With *zero* over-unity results that *ever* could be reliably duplicated.

All of this ground has now gotten thoroughly plowed. Many times.

Yet, sometimes I wonder. I certainly know what it is to scream and shout about a new or unpopular idea only to be ridiculed and ignored. And then have the plans stolen when the time was ripe for a ripoff.

Even personal computers were once that way. Nobody ever asked a model railroader *why* he played with his toy trains. But *everbody* used to ask what personal computers were good for. You'd answer just for fun, to compute or to get filthy rich. And they'd come back with "Yeah, but what are they good for?" Over and over again.

I dunno. I've waded through most of the UFO stuff pretty thoroughly. And have personally written most of it off. Nearly all of it, in fact. *Except* possibly for Roswell. Which I feel at least remotely approaches the bounds of potential credibility and possibly *might* be worth a closer look.

Much of UFO lore is single sourced, coming from a lone individual. Who could simply be lying or stoned out of their gourd. Or a few chips shy of a full board. There are *hundreds* of bit players in that Rosewell story. Each seems to offer credible factoids.

As an electronic engineer, I flat out do not buy perpetual motion. At least not on a normal everyday scale. But then again, maybe, just maybe some perpetual motion attempt might mask something else useful that *might* be coming down.

So, let's go and build us...

A Perpetual Motion Machine

There was quite a flap a decade ago over a magic motor which seemed to run forever on batteries. This one still shows up on late night tv shows, and the books are still offered. Obviously, it hasn't gotten anywhere.

Yet, there were true believers who genuinely felt that something unusual was happening to cause the batteries to self-recharge.

Instead, could something totally different be coming down? Something both within the bounds of real science and possibly useful?

Uh, it seems that while perpetual motion was claimed, the real effect seemed to dissapear when you used a power supply instead of batteries. Or even placed a diode in series with the batteries. Also, as our second clue, the motor did tend to spark a lot while generating high current spikes.

Now, let's turn to some real science. Carbon-zinc batteries do not exhaust themselves because they've run out of chemical energy. Instead, their series resistance keeps increasing until they can no longer deliver useful power. This process is called *polarization*. In theory, *so long as even a tiny scrap of the zinc case remains, there still is some recoverable chemical energy remaining.*

A second observation is that most carbon-zinc batteries *last much longer when used intermittently*. The curves clearly show more deliverable power if you discharge them four hours per day instead of continuously.

What happens if we *recycle* some of our battery power in the form of large but brief high current spikes? Could we slow down how fast your internal resistance goes up this way?

Any battery uses electrochemistry. Electroplaters routinely *reverse* their supply current every now and then to purposely *unplate*. They will do this to smooth out the finish and prevent any jaggies and blemishes.

So what happens if we, say, draw 200 mils out of our D cell all the time. But *return*, perhaps 10 amps for five milliseconds per second. One quarter of our power would go right back into the battery. Now, normally, this will not accomplish much. But maybe, just maybe, it could delay the onset of the increasing cell resistance and increase the apparent life.

The evidence from the perpetual motion machine, from the life curves, and from the electroplaters says this just may work. Naturally, whether it would be useful and cost effective is another matter entirely.

The battery people have made all sorts of recharging tests. But as far as I know they never have tried to find out what happens when you recycle part of the load current as narrow and high power current spikes.

Conceivably, this could lead to a snap-on cap that may increase battery life. Reusable, of course.

Why don't you try it and tell me whether it works? This might make an interesting student lab project or a science fair entry. If it really works, there are big bucks to be made. One safety tip, though: Do use a "bomb shelter" consisting of a paint can full of sand. Just in case. And work *only* with plain old carbon-zinc cells.

At first, you wouldn't have to really recycle the power, just keep track of power out versus power in and see if there is any net change in overall life. Any old power MOSFET could do the pulse switching.

Your snap-on cap could include a step-up inverter and capacitor storage system. A timing circuit would then discharge the stored energy back into the cell as a brief pulse.

If anything promising shows up, the next steps are to find out which currents and duty cycles perform the best. And how well they'll behave on different brands of cells.

This Month's Contests

For our contests this month, just tell me your favorite pseudoscience story.

Or put me on to any pseudoscience resource that I don't know about yet. Or see if you can get a measurable net battery life gain by continuous pulse energy recycling.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For fast modem access, use (800) 638-8369 and enter HHH. When prompted, enter XTX99005,SCRIPT.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552.

Don Lancaster's

RESOURCE BIN

number twenty-seven

Electronic servicing opportunities.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place to go for instant tech answers. Among the many files in our library, you will find complete reprints and preprints for all of my *Resource Bin* columns. I've just added a new "fast access" feature for you. Have your modem dial (800) 638-8369, followed by HHH. Then XTX99005,SCRIPT.

By the way, be sure to enter your HHH *immediately* after your modem software reports a connection. This is how *GEnie* recognizes your baud rate. If you get gibberish on the screen, you were too slow with your HHH.

A free *GEnie* brochure if you voice call (800) 638-9636.

A reminder that all of the previous *Resource Bin* columns are offered both online and as bound volumes. I have also just done a major update to my free *insider secrets* catalog. Give me a helpline call or see my *Synergetics* ad for more details.

I have gotten a lot of requests lately for info on where to go to get info for doing your own electronic servicing and repair. Sadly, the opportunities for home based repair setups have gotten rather ugly over the years. And aren't likely to improve any.

Starting your up own home repair service for, say, computer monitors, simply is not realistic these days. And most consumer electronics warranties apply *only* to properly authorized and trained dealer networks.

Very simply, it used to be cheaper to fix things than replace them. No more. Repairs were vastly simpler. Less skill was needed to understand what was coming down. Firms were far more open with their tech manuals and their replacement parts. And, of course, most service problems these days are software related.

On the other hand, most electronic gear is infinitely more reliable today. It just doesn't break in the first place. Unless it gets hit with lightning.

Yet there are bucks to be made in a scant few specific areas. VCR repairs, microwave ovens, and laser printers seem to be your best ongoing bets.

Some First Principles

Before we look at some places to go for electronic service help, let's check into some seldom-discussed ideas that I've found useful to handle most any servicing problem…

Make sure the problem is real– Be sure that the actual difficulty and what you think the problem is are the same. An intermittent cannot be fixed until you can make it appear on command.

Look before you leap– More often than not, a careful visual inspection and a long talk with the owner will pinpoint the problem. When you jump right in, you'll miss the obvious every time.

NEXT MONTH: Don looks at several insider secrets for electronic breadboarding

Use the right tools– These days a decent oscilloscope can be had for as little as $50. It is totally *unthinkable* to *ever* try *any* electronic repair without one.

Find the cause, not the symptom– Most electronic systems fail for a reason. Fuses blow because of circuit faults. Resistors burn up because of way too much current. Power stages can fail because of overload, tuning, or a lack of drive. Replacing obviously "bad" parts with new ones will only burn up the new parts.

Cause the patient no harm– On any larger, older, or antique electronics (especially anything that has not been turned on for years), do not *ever* apply power until passive resistance checks clear the way!

Supplies. Then signals, Then loads– If you are dealing with any modern piece of electronic gear whose power supplies are self protecting, check first to find line power or source current present. Then test for correct voltages in appropriate places. Next, look for proper signals at suitable points in the circuit. Finally make sure loads are reasonable and well behaved. Along the way, touch, feel, and smell.

Think twice, measure once– There's no point in measuring anything that ain't broke. Think out what you are going to do ahead of time. Try to zero in on the *one* test that tells you the most.

Divide and conquer– If you find out where the problem is *not*, you can divide the remaining places to look in half. Repeating this several times will isolate the problem. For instance, on a radio, touch the volume control with your finger (after making sure you have a cold chassis, of course!). If you produce hum, your audio and supply power is ok, and you've got a rf, if, or antenna problem.

On any mechanical engine problem, determine both fuel and spark. Ask what nutrient is missing.

On a computer interface problem, use the simplest possible tests done at your lowest possible software levels first. There is no way an applications package will work if the comm wires are crossed. Or if the baud rate or stop bits are wrong. Printer handshaking doesn't usually get to be a problem till

after a page or so. So, no printing at all is a more fundamental problem than a delayed handshake.

Substitute and simplify– These are your two most powerful weapons. If you can compare a good unit against a bad one, always do so. But *never* put any potentially bad parts on back into the good unit. The plague can spread.

Make the problem worse– If all else fails, find the simplest possible setup in which *only* the problem exists. Get rid of all extra side effects, of all fancy software, all possible places to hide. Eliminate *everything* extraneous.

MSM and Electronic Servicing

There are very few magazines that target electronic service work. I have only been able to find two so far.

One of these is *Electronic Servicing*, which is big on consumer electronic repairs. Especially tv sets and VCR's. Their ads include some major supply sources for repair parts and exchange modules. They also supply a *ProFact* centerfold each month, and often do include useful directories.

MSM is also called the *Magazine of Service Management*. This one is more aimed at computer peripheral repairs, especially larger dot matrix printers and hard disks.

There's a few electronic technician associations which do offer member newsletters and similar services. Not being much of a joiner, I've personally found these outfits to be of very little use. It is also unclear to me just what real benefits they offer. As with most other fields, "certification" programs simply do not work.

Still, you might like to check into the *ETA Technician Association News* and the *ISCET Update*. Or the *Servicer Newsletter* from the *United Servicers Association*. Or the *NESDA*, short for the *National Electronic Service Dealers Association*.

Your traditional source for service info has been *SAMS* PhotoFacts, who are now only the faintest shadow of their former selves. They do offer an excellent directory. Full collections of older Photofact sets often are offered here in *Nuts and Volts*.

More obscure service and schematic info is sometimes offered by *Bomarc Services*.

ECG and NTE

The two leading sources for repair and replacement semiconductors are *ECG* and *NTE*. These folks both have low cost reference manuals available. So does *Radio Shack*, who also offer an extensive parts locator service and a few cross reference directories.

Info on who makes what in the way of semiconductors is available by way of the pricey *EEM Master*.

A number of companies specialize in foreign transistors, with the real biggie being *MCM Electronics*. Three outfits having lots of VCR parts and support are *MAT Electronics*, *Premium Parts*, and *Parts Express*.

One specialized VCR tool source is *Tentel*. A source of television repair modules is *PTS Electronics*.

Several ic distributors specialize in stocking ancient or otherwise obsolete parts. Two of the leading firms here appear to be *Rochester Electronics* and *Sunset Silicon*.

For *really* old radio parts, there's an entire separate world of electronic collectibles. We looked at lots of these last fall. Two useful starting points here are *Antique Radio Classified* and *Antique Electronic Supply*.

Laser Printers

Desktop publishing laser printers, especially those speaking PostScript, are one of the few areas where there are genuine opportunities for smaller scale custom services. Besides repairs, there's toner cartridge reloading, hard drum refitting, upgrades, and used machine sales.

Most leading printer manufacturers (especially Apple Computer) are real snotty when it comes to providing any service or repair info. Fortunately, most of the major laser printers use identical mechanical engines. Which means that the info from one supplier is largely good for another.

Hewlett Packard Manuals offer some outstanding repair manuals. These may also be quickly and conveniently used on Apple, *QMS*, and other *Canon* engine based systems. Sadly, all the prices are rather steep at $120 or so each. But the first use will usually pay for the manual many times over.

Some laser printer repair schools are outright scams, and a few others have really bad reputations. But one that I have found a major exception is *Don Thompson*. Who offers top quality training seminars, videos, parts, and module exchanges.

Your first test for any school is to ask for a list of satisfied customers in your area. If they do not *immediately* comply, *run* away from them.

The center of the laser printer repair

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MCM Electronics
650 Congress Park Drive
Centerville, OH 45459
(800) 543-4330

NESDA
2708 W Berry Street
Ft. Worth, TX 76109
(817) 921-9061

NTE
44 Farrand Street
Bloomfield, NJ 07003
(201) 748-5089

Parts Express
340 E First Street
Dayton, OH 45402
(800) 338-0531

Play Meter
PO Box 24970
New Orleans, LA 70184
(504) 488-7003

Premium Parts+
PO Box 28
Whitewater, WI 53190
(800) 558-9572

PTS Electronics
5233 Hwy 37 South
Bloomington, IN 47401
(800) 844-7871

Recharger
4218 W Charleston Blvd
Las Vegas, NV 89102
(702) 438-5557

Redmond Cable
17371-A1 NE 67th Court
Redmond, WA 98052
(206) 882-2009

RePlay
PO Box 2550
Woodland Hills, CA 91365
(818) 347-3820

Rochester Electronics
10 Malcolm Hoyt Drive
Newburyport, MA 01950
(508) 462-9332

SAE Library
400 Commonwealth Drive
Warrendale, PA 15096
(412) 776-4814

SAMS PhotoFacts
2647 Waterfront East
Indianapolis, IN 46209
(800) 428-7267

STAR Tech Journal
Box 1065
Merchantville, NJ 08109
(609) 662-1080

Sunset Silicon
402A Ridgefield Circle
Clinton, MA 01510
(508) 365-6108

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

Tantel
4475 Golden Foothill Pky
El Dorado Hills, CA 95762
(800) 336-8277

Don Thompson
6 Morgan, Ste 112
Irvine, CA 92718
(800) 457-5776

United Servicers Assn
PO Box 626
Westmont, IL 60559
(800) 432-0972

industry is *Recharger* magazine. This one has hundreds of ads for supplies, training, and related materials. Plus tech and service info.

One good source for special laser printer cables and most interconnects is *Redmond Cable*.

Copier repairs are generally a bad scene, owing to previous ugly vibes within a sick industry. But there is a *Copier & Imaging Technology* mag.

We also have a lot more info on laser printing opportunities up on my *GEnie* PSRT. You can start out with our TONERTRX.PS file.

Microwave Ovens

Microwave ovens are yet another consumer electronics item that's fairly easy to fix. Besides the maggie itself, you've got a power supply, a timer, and some safety interlocks.

Sources of replacement magnetrons are once again *MCM Electronics* and *MAT Electronics*. Typical costs are in the $36 range or so.

Electronic Organs

I'm amazed that any interest at all remains in electronic organs, since a modern synth gives you a thousand times the instrument for far less than one tenth the cost. At any rate, most electronic organ chips are no longer manufactured.

One possible source for original electronic organ top octave generators and keyers is *Fistells Microelectronics*. They specialize in stocking what few devices remain, along with modular workarounds.

Arcade Video Games

There is a lively market in older arcade video games. Their electronics is rather crude and simple, and most of the service problems relate to plain old abuse. The usual complaint is a big lack of interest in anyone putting quarters in them anymore.

You'll find two major trade journals here, namely *Play Meter* and *RePlay* magazines. There's also supposedly a techie pub known as the *STAR Tech Journal*. But I was unable to get further info on this one by press time. So this one is only a maybe.

One source of video game repair info is *Randy Fromm*. Who has books, videos, hands-on training schools, repair parts, restoration services, and exchange modules.

Some really good stuff.

Tech info on older electromagnetic pinball machines is surprisingly easy to get. One superb source is *Steve Campbell's Pinball Pages*. Much more on pinball resources in general in my file HACK75.PS which I have recently uploaded to my *GEnie* PSRT.

Auto Computers

Useful information on automobile computers is extremely hard to come by. First because much of it is treated as insider trade secrets. And secondly, because there are *severe* EPA penalties for modifying any car computer in any way. Ferinstance, if you modify a car computer such that it dramatically *reduces* your pollution and *increases* your mileage, you have committed a felony. The feds will lock you in jail and throw away the key.

Some info on car computers does appear here in *Nuts & Volts* ads. You can also try to use the *SAE Library* for background info. I've also found *Pact Services* to be a useful resource here. You might also check the ads in the performance mags.

A Service Yarn or Two

The all time classic tv service story involved a technician dealing with a problem customer. What he finally did was adjust their tv set to a slow vertical roll. Then told the customer to pick the picture they wanted.

My own toughest electronic service job ever? It involved an intermittent mid air short circuit, and boy, was it ever hard to find.

This one was on a fire alarm system for a small Arizona town. Known as a *Gamewell Fire Alarm Telegraph*. What you basically had was a single wire about 36 miles or so long that wound up one alley and down another to the little red boxes on each street corner. Inside of each box was an incredibly sophisticated spring mechanism the size of your fist.

When tripped, a box would spell out its location by a cam breaking the line circuit in a certain pattern. As I recall, 2-3-1 was the station itself, and other codes led to specific areas in the town. What you have here, of course, is a local area network.

Amazingly, this 1880's technology (yeah – the EIGHTEEN eighties!) was smart enough to avoid all its packet collisions by making sure the line was not in use before sending its own code! Obviously, two pulled boxes would generate garbage without packet collision avoidance.

The box was also smart enough to test the line's signal quality! If the fire ever burned through the alarm line, an alternate circuit through ground was selected by way of a balanced relay. There were self-test provisions and a method at each box to short out part of the system for debugging.

You want a baud rate? You got it. One baud! That was the rate the box number got spelled out, repeating five times and then quitting. Back at the station, a relay at the top of the wet cell battery supply tripped a honker made from three Santa Fe diesel air horns. A separate relay at the bottom of the battery supply tripped a paper tape printout device.

And therein lay the problem. The tape device was something of a great grandfather to a teletype punch. The theory was that you could read this tape if you were late responding to the fire station.

The symptom was obvious enough: very late on certain very rare dark and windy nights, there would be all sorts of tape punched out on the floor. And the punched numbers simply didn't make sense at all. In fact, most of the time, there was a total rip down the middle of the tape, rather than being any identifiable numbers.

Now the tape wasn't used all that much, but *any* reliability problem in a fire alarm system is bad news. Their documentation for the system was largely missing or illegible and had gone through several upgrades over the years. The original thought was that there was some loose connection somewhere in the decades old system.

And would I please find it?

The problem with blaming an open circuit is that the honker would also have tripped. *That* would have been easy to find and would have promptly gotten everyone's attention. Whether they liked it or not. Thus, you never knew when the problem was going to appear. You just had to wait till the middle of a dark and windy night and then go down to the firehall and hope to catch the culprit in action.

Which got old in a hurry. Finally, on one exceptionally windy night, I did manage to catch our gnome in action. I watched the tape spitting out on the floor, ran out across our town, shorted out half of the alarm system, and came back. The tape stopped. I repeated the process three times just to be sure. Now, instead of having 36 miles of problem, I had narrowed it down to a mere 18.

Naturally, the wind died down by then, preventing further tests.

At least we had now proven that the problem was real and not some sort of a bizarre hoax.

Yeah, I thought of some kind of recording time domain reflectometry setup. And of putting a transmitter on the tape punch to let me know when the problem was coming down. But this was a low budget and low time operation. And I still wasn't sure exactly what we had.

This excruciating process of wait for the wind, short-unshort-short-unshort went on for months. The only bright spot was that the symptoms were gradually getting *worse*. At long last, I narrowed the problem down to two boxes one block apart. The wire went out one box, twenty feet straight up in the air, around the block, and finally twenty feet straight back down to the other box. Mid-air short or no, the problem *had* to be in this wire!

The next morning, I hopped on my bicycle and inspected every inch of the offending wire.

Nothing. Again. Nada.

But wait! Near the alarm wire but not in contact with it was a residental house drop that consisted of three twisted power wires and a *grounded* (!) supporting guy wire. What was happening was that the power poles would flex enough in very high winds to cause the guy wire to saw its way through the alarm wire insulation.

Causing an intermittent mid-air dead short!

In retrospect, it probably would've been faster and simpler to physically inspect the entire 36 miles an inch at a time. When we did this after the fact, we found three more problem areas. But there was no guaranteeing that it was a wire problem in the first place. And, as with any service hassle, you usually don't know what you really have until after you fully solve the problem once and for all.

But this one certainly was a good example of how divide-and-conquer can be a useful service technique. And how most forgone conclusions (a mid-air "ground" can't happen) can lead you to ongoing grief.

I also never picked up on the fact that the cause *had* to be some high frequency event, when compared to the intended baud rate.

This month's contest

As usual, I suspect I have missed several important electronic servicing resources. So, just tell me about any other resources. Or share an unusual servicing story with us.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

More on resources for electronic servicing appears in our collected *Resource Bin* reprints. Available in book form per my nearby *Synergetics* ad, or on line from *GEnie* PSRT.

Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For fast modem access, use (800) 638-8369 and enter HHH. When prompted, enter XTX99005,SCRIPT.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM.

Don Lancaster's

RESOURCE BIN

number twenty-eight

Secrets of electronic breadboarding.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints and preprints for all of my *Resource Bin* columns. For quick access, just have your modem dial (800) 638-8369, and type HHH. Then JOINGENIE,DMD524.

I did manage to wrangle a super special signup deal for you *Resource Bin* readers. Ten free hours and zero first month minimums.

By the way, be sure to enter your HHH *immediately* after your modem software reports a connection. This is how *GEnie* recognizes your baud rate. If you get gibberish on the screen, you were too slow with your HHH.

I've also now got a brand new free catalog for you that includes a greatly expanded insider secrets section. Call or write for your copy. Or grab it off PSRT as SYNCAT1.PS.

Many thanks for the dozens of calls I got over our pseudoscience column. So here are a few updates: *Lindsay Publications* somehow just missed the final cut of the story. But these folks do stock several pseudoscience titles. They are also very strong on earlier radio books and turn of the century machine shop lore. Free catalogs.

I also found an absolute gem called the KEELYNET BBS that is up at (214) 324-3501. This one covers free energy, antigravity, sympathetic vibrations, strange medicine, UFO's, paranormal experiences, the whole nine yards. Even a urine powered car. The service is free and is sponsored by *Vangard Sciences*. They also have files on disk.

Be sure to watch closely for their sign-off screen. It lists a dozen other pseudoscience boards.

One caller got rather upset when he found I did not believe in dowsing. Well, yeah, I do see our local utility company routinely using these.

I also think I know one reason why my utility bills are so high.

Actually, many years ago, I was given some dowsing rods for a story I was doing for *Electronics World*. After repeated and careful attempts, I was unable to get them to work. So were several dowsing fans I loaned them to. At that time, I was unable to find so much as one scientifically credible paper which was able to convincingly support dowsing.

As far as I know, there still aren't any. One free *Incredible Secret Money Machine* if you can prove me wrong. But don't load me down with third hand anecdotal mythology.

Electronic Breadboards

To create a new technical product, you have to go through a number of distinct steps. Steps which take you from an initial idea up through a final product. One traditional method was called an electronic *breadboard*. Which today means any old lashup that gets most of your hardware working more or less in the way you pretty much intended it to. Without any regard for durability or compactness.

NEXT MONTH: Don looks at little known supply sources for the cable tv industry.

At one time, electronic breadboards were just that. Flat and wide pieces of wood onto which you nailed or bolted your components. Snap-in connectors called *Fahnstock clips* were often used for those portions of the circuit where you wanted to add or remove wires.

Amazingly, Fahnstock clips still get sold by *Antique Electronic Supply*.

Is Breadboarding Needed?

The purpose of a breadboard is to find the problems and flaws. Between where you really are and where you want to go. Especially rude surprises and stuff you've overlooked. At one time, breadboards were the be-all and end-all of project development. These days, they are only one of several useful tools. And a quite costly and time-consuming one at that.

Ferinstance, a computer model can often tell you bunches more than any breadboard can. Faster and cheaper. I once worked on an *intelligent tap* for a cable tv system. This let you connect and disconnect service from the head end to eliminate any need to dispatch a truck for routine service calls.

We first modeled this system with a large pile of Apple computers. All of their game paddle ports were strung together in a simple network, with one Apple being the front end, and the others serving as ersatz customer taps. From this simulation, we learned what was really important and what was not for the ultimate hardware.

Computer simulations can also do a lot in the way of conventional circuit design. The real biggie here is SPICE, but there are lots of other options. SPICE disks are often free from the ic houses. You will also find computer *virtual breadboard* systems. These can let you verify your component values before you select them.

One obvious method for computer simulation is a *Commodore* C-64 picked up for $30 at a yard sale. Sometimes a beast like this can *completely eliminate* any need for your circuit in the first place. A careful and thoughtful use of computers might dramatically reduce

any need for breadboarding.

Another question to ask is whether a traditional electronic circuit is the best way to go at all. These days, you are almost *always* going to be much better off by going to a programmable method of some sort. Or to a plug-in personal computer card.

The advantages of programmable solutions are that they are very easy to change, much faster and simpler to use, are almost always cheaper in the long run, and can be reused.

As an example, one caller recently wanted a circuit that counts to twenty and then provides his output. Well, you might grab my *CMOS Cookbook* and whump a breadboard up out of four or five chips. Or, you could do the entire job in a single chip EPROM, just by feeding some of the outputs back on its own inputs.

Better yet, a $2 PLA or PLD logic device might give you an even lower cost and simpler solution. My vote here is to use a microcontroller, such as that low cost *Basic Stamp* from *Parallax*. More information on low end microcontroller designs show up in such magazines as *Circuit Cellar Ink* and *Embedded Systems Programming*.

Is breadboarding needed? Yes, if you want to learn something about electronics. Yes, if you have to have solid proof that your concept works. Yes, if you are up to something tricky or far out. But outside of these, you should aggressively *minimize* the need to do breadboards by creative use of computers, microcontrollers, and the other programmable solutions.

Perf Board

One obvious way to build things is often called *rat's nest wiring*. Because today's integrated circuits are higher frequency devices that *demand* clean and well bypassed supply lines, most rat's nest circuits simply do not work.

And are likely to end up as a total waste of your time and effort.

But this route could sometimes be handy to test simple control, alarm, or audio circuits. But *only* when you are exceptionally neat, keep all the leads sensibly short, and thoroughly bypass all your supplies. The obvious biggie here is *Radio Shack*, who offer a wide selection of perfboard stuff.

You simply shove the components through their holes and then solder them to the pad areas. Ordinary wire of one sort or another is then used to interconnect the pads.

Your two big supply houses for breadboarding materials are *Keystone* and *Vector Electronics*. Naturally, you will also find lots of breadboarding stuff right here in our *Nuts & Volts* ads, and in just about any surplus or electronic distributor catalog.

Nearly all of those electronic trade journals have breadboarding product info in them. The two with the most are *Electronic Component News* and *EE Product News*.

Much more on trade journals in the *Resource Bin* reprints.

Vector did have a useful perfboard tool a long time ago that I really liked and used a lot. Sadly, this one seems to be long gone. This was their *Vector Wiring Pencil*. Which was really a pencil shaped carrier for a small roll of solderable magnet wire. Solderable magnet wire has a special insulation on it that vaporizes when raised to soldering temperatures. Its intended use is to eliminate any stripping when winding electrical coils. Most any large wire source should have this as a specialty item.

You can try *MWS Wire Industries*.

Solderless Breadboards

Perfboard can quickly turn into a nightmare kluge. A few decades back, *solderless breadboards* were introduced that were much quicker, cleaner, and more convenient. These are just big blocks of white plastic that have short connector strips in them. You plug your components in, and then add all your plug-in wire jumpers.

Solderless breadboards are useful for learning electronics and for quick checks of small and simple circuits. You can easily find these, with *3-M* being a leading manufacturer. Start with *Radio Shack*, our *Nuts&Volts* ads, or your favorite electronic distributor. The best source for the wire jumpers is *Squires Electronics*, who offer some handy low cost kits. These will often have color coded wire lengths. Bulk wire packs are also available.

Solderless breadboards are usually offered as minis, singles, three-wide, and five-wide. They are sometimes mounted on a metal chassis that can support the power connectors. Some fancier units may include built-in power supplies. And fancier ones still are intended as student workstations and as total breadboarding systems. *Heath* is one good source.

Yeah, Heathkit is still in business. Only they are much smaller and have tightly focused themselves on their industrial education products.

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PostScript Beginner Stuff	$39.50
PostScript Show and Tell	$39.50
Intro to PostScript Video	$39.50
PostScript Reference II	$31.50
PostScript Tutorial/Cookbook	$19.50
PostScript by Example	$31.50
Understanding PS Programming	$29.50
PostScript: A Visual Approach	$22.50
PostScript Program Design	$24.50
Thinking in PostScript	$22.50
LaserWriter Reference	$19.50
Type 1 Font Format	$15.50
Acrobat Reference	$24.50
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Write in 146 on Reader Service Card.

Wirewrap

Wirewrapping is an old aerospace technique for creating one or more copies of a complex circuit that may need extensive debugging.

Unlike regular sockets, wirewrap sockets have long square-pinned tails on them. Special manual or automatic tools are used to twist prestripped wires onto these tails. #30 *Kynar* wire is normally specified.

One leading supplier for wirewrap tools and the prestripped wires is **OK** *Machine*. Once again, *Radio Shack* also offers the essentials. One two-ended manual tool is all you'll often need.

One end wraps. One end unwraps. The middle strips.

Augat is one leading (but pricey) supplier for wirewrap boards.

Bought new, wirewrap assemblies can be obscenely expensive. Most are literally gold plated. But if you look around surplus, you might be able to locate prewrapped wirewrap bays at astoundingly low prices.

Vector does produce a variant on wirewrap called *Slit-n-wrap*. This one uses roll feed and a slitter to eliminate the need for prestripped wires.

One of your foremost rules when wirewrapping is to *never daisy chain!* If several points are to get connected together, wrap the first pair low, the second pair high, the third pair low, and so on. If you use the obvious high to low, high to low, high to low, etc, you might have to undo your *entire* chain for a minor fix.

Wirewrap pins normally support up to three wraps. Another very good rule is to reserve any third wraps for emergencies. Restrict yourself to two wraps per pin. Besides not boxing yourself into corners, it is much easier to slide a test connector over a single wrap or a double wrap pin.

Because it is ungainly and costly, wirewrap is no longer popular. There is no economy of scale in wirewrap, which will pretty much restrict it to one-off uses. Your second copy takes as much time and effort as the first.

Prototype Printed Circuits

No point-to-point wiring system can compete with a printed circuit when it comes to cheap copies, repeat accuracy, total control of strays, and high frequency performance. So, it is real hard to beat a printed circuit for most breadboards.

We looked at printed circuit board options back in previous columns. Of the "old way" routes, there are crude *direct* techniques (cut or paint), *silk screen*, and *photo* methods.

With either the silk screen or the photo method, you create a 1:1 photo image from your artwork, and then expose a photoemulsion. The coating then decides what board copper will get removed by etching, or which holes are to appear in the silk screen.

The leading supplier of traditional printed circuit materials and supplies is *Kepro*. Of the photomethods, I very much do prefer the *dry film laminate*, since it is fast, easy, and pinhole free. You usually get printed circuit boards with the dry film preapplied.

For etchants, ammonium persulfate or a sodium persulfate is infinitely preferable to messy and opaque old ferric chloride. Etching can be done by sloshing, bubbling, or spray.

The two big beginner mistakes on printed circuit boards are not using squeaky clean copper or trying to etch with too low a temperature. Properly cleaned copper is not copper colored at all. It is instead a hot pink. And will allow an unbroken stream of water to freely flow over it. Any clorine based kitchen cleanser (*Comet*, etc.) does a good cleaning job.

Special cleaners are also available.

The longer the etch time, the worse the performance, and the greater the odds of undercutting and pinholes.

The activity of most etch processes doubles with each twelve degrees or so increase in temperature. The best etching temperature is 120 degrees. One easy way to hit this temperature is with a yard sale warming tray.

A hint: If you are doing a simple slosh etching, etch your board *upside down* and supported a quarter inch or more off the bottom of the tray. Use a plastic clip or standoff to provide the spacing. With upside down etching, grundge will tend to fall *off* the board instead of on to it.

There has been some newer work where conductors get directly printed

ELECTRONIC BREADBOARDING RESOURCES

Antique Electronic Supply
6221 South Maple Avenue
Tempe, AZ 85283
(602) 820-5411

Aptix
2890 N First Street
San Jose, Ca 95134
(408) 428-6200

Augat
452 John Dietsch Blvd
Attleboro Falls, MA 02763
(508) 699-7646

Circuit Cellar Ink
4 Park Street, Ste 20
Vernon, CT 06066
(203) 875-2751

DynaArt Designs
3535 Stillmeadow Lane
Lancaster, CA 93536
(805) 943-4746

EE Product News
707 Westchester Avenue
White Plains, NY 10604
(914) 949-8500

Electronic Component News
1 Chilton Way
Radnor, PA 19089
(215) 964-4345

Embedded Systems Pgrm.
600 Harrison Street
San Francisco, CA 94107
(415) 905-2200

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

Heathkit
PO Box 1288
Benton Harbor, MI 49022
(616) 982-3200

Kepro
630 Axminister Dr
Fenton, MO 63026
(800) 325-3878

Keystone
31-07 20th Road
Astoria, NY 11105
(718) 956-8900

Lindsay Publications
PO Box 538
Bradley, IL 60915
(815) 935-5353

MWS Wire Industries
31200 Cedar Valley Drive
Westlake Village, CA 91362
(818) 991-8553

NASA Tech Briefs
41 E 42nd Street, Ste 921
New York, NY 10017
(212) 490-3999

OK Industries
4 Executive Plaza
Yonkers, NY 10701
(914) 969-6800

Parallax
6359 Auburn Blvd, Ste C
Citrus Heights, CA 95621
(916) 721-8217

Pioneer
Box 1720
Long Beach, CA 90801
(213) 835-6177

Printron
8917 Adams Street NE
Albuquerque, NM 87113
(505) 823-1990

Quality Semiconductor
851 Martin Avenue
Santa Clara, CA 95050
(408) 450-8063

Squires Electronics
503 N 13th Avenue
Cornelius, OR 97113
(503) 357-7132

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

Techniks
45 J Ringo Road
Ringoes, NJ 08551
(908) 788-8249

3M
3M Center
St Paul, MN 55144
(800) 328-1303

Vangard Services
Box 1031
Mesquite TX 75149
(214) 324-8741

Vector Electronics
12460 Gladstone Avenue
Sylmar, CA 91342
(818) 365-9661

Vero Electronics
1000 Sherman Avenue
Hamden, CT 06514
(203) 288-8001

onto an insulating base, eliminating all of the etching steps. Some of these are inkjet compatible. Time will tell whether direct print will ever become a useful prototyping tool. One outfit working on this is *Printron*.

Additional info also appears in the **NASA** *Tech Briefs* for August 1989.

The Direct Toner Method

There is now an exciting alternate method to making prototype printed circuit boards. This is called the *direct toner method*. Only recently has this process gotten really reliable.

A laser printer toner is mostly a polyethylene plastic. It makes a fine etch resist. To apply the direct toner method, you use a PostScript laser printer to create a reversed 1:1 toner image. That image then gets bonded directly to the printed circuit board and becomes your etch resist. *All* of the intermediate steps of those older methods get eliminated. You can now easily make your own printed circuit prototypes on your kitchen table in minutes for pennies.

Nearly all the earlier direct toner offerings suffered grievously from partial transfers. Some of your toner would transfer and some would not, leading to bad dropouts. More people swore at these early attempts, rather than by them.

But this is now ancient history.

Your leading supplier for second generation direct toner materials and supplies is *DynaArt Designs*. They do offer total systems of suitable toner, reliable transfer materials and presses, and a gentle and toner-friendly wave etching system.

The transfer material has a water soluble release coating. You print it on your PostScript printer. It is totally *unthinkable* to not use PostScript here. Microsizing for media stretch is one of many important reasons.

Your transfer material then gets bonded to the printed circuit using a heat press. A few people sometimes have luck using an iron, but the heat press does a much better job much more of the time. After bonding, the board is soaked in water, dissolving a release coating and letting the backing sheet float away. Differential transfer problems are eliminated since none of the toner stays on the sheet.

As before, ultra clean copper and a higher etch temperature is absolutely essential. So is PostScript. So is using a printer rather than a copier.

This same process can also be used to transfer toner onto nearly anything. Such as dialplates, panels, or awards.

If you want to make up your own transfer sheets, just get an archival quality grade of premium white glue from a large art store, dilute it with water, and apply it to a heavier sheet of paper with a windshield wiper.

A second supplier of direct toner systems is *Techniks*. Their approach is to provide a release coating on their backing sheets. A coating that toner only loosely sticks to. After thermal transfer to your printed circuit board, the backing is peeled off. The release coating minimizes transfer hassles.

A Better Way to Breadboard

There's a brand new breadboarding method that's taken the industry by storm. Sadly, the price is still a tad too high for many personal uses. But this is about to change in a big hurry.

It's called *programmable interconnect*. For years now, we have been able to rearrange the apparent wiring *inside* of EPROM's and other popular chips. With programmable interconnect, we can now also rearrange the apparent wiring *between* any collection of chips on a printed circuit board.

Wouldn't it be great if you could have a magic *software* programmable robot that would tirelessly wire up all your prototypes for you? Sorta like having a giant automated patchboard where lots of wires could instantly be combined in any pattern?

You are probably familiar with the CMOS 4016 or 4066 chips. These hold four *transmission gates* that can behave as plain old analog or digital switches. Picture instead a package having *one thousand* pins and enough gates that you could connect each and every pin to each and every other one in nearly any pattern. On power up, serial data is fed into an internal RAM memory area that holds the wire patterns.

The chip that I am describing is the *Aptix* AX1024R. They also do offer a slightly pricier APX1024D version that splits out 64 of the pins into a separate I/O connector. This is dandy for test and debug, for you can connect any test point *anywhere* in your circuit under software control.

Aptix has a free video on their new programmable interconnect devices available, along with the usual data sheets and ap notes. They also offer complete breadboarding systems.

Ferinstance, the FPCB AXB-AT2 is an IBM PC compatible card that holds two programmable interconnects and room for dozens of your own devices.

Around 1700 interconnections are fully programmable, which is more than enough for most jobs. That's over a hundred 16 pin chips. Development and support software is included.

Each programmed interconnect is less than 150 Ohms. Which is useful for circuit interconnects up to fairly high frequencies. Supply and ground connections and any higher current outputs are directly hardwired on the breadboarding area.

We can shortly expect lower prices, more hacker friendly devices, and new non-volatile connection storage.

If you find the Aptix products are still too pricey for your tastes, you can conjure up your own programmable interconnects, using the ridiculously cheaper bus switch integrated circuits by *Pioneer* and *Quality Semiconductor*. These also do offer significantly lower resistances in the 5 Ohm range. But you are talking dozens of gates per package instead of tens of thousands.

More on this topic in HACK75.PS on *GEnie* PSRT.

This Month's Contest

For our contest this month, just tell me about a breadboarding resource or technique I don't know about.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

Lots more on breadboarding in our *Resource Bin* reprints and also in my *Incredible Secret Money Machine*. Plus, of course, the thousands of files now up on *GEnie* PSRT. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

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Don Lancaster's

RESOURCE BIN

number twenty-nine

Cable and video insider sources.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints and preprints for all of my *Resource Bin* columns. For quick access, just have your modem dial (800) 638-8369, and type HHH. On the password prompt, enter JOINGENIE. On the keyword prompt, enter DMD524.

I did manage to wrangle a super special signup deal for you *Resource Bin* readers. Ten free hours and zero first month minimums.

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I've also now got a brand new free catalog for you that includes a greatly expanded insider secrets section. Call or write for your copy. Or grab it off PSRT as SYNCAT1.PS. You can also get it via the Internet.

This month, I thought I'd gather together a few of the more obscure and harder-to-find resources in and around the cable tv industry. Plus a few "pretty nigh but not plumb" tv, radio, and video sources.

I guess I'm probably the *last* person who should be doing this, since I *never* watch *any* cable or television.

Organizations and Standards

One professional organization is the *Society of Cable Television Engineers*, or SCTE for short. Membership is $40 per year. Their main goals are standards, training, and certification. Despite the name, most members are not degreed engineers. There are also lots of the usual regional chapters and meeting groups. These can be useful for local professional contacts.

Another organization is the *National Cable Television Association* or NCTA. These folks also publish the *Techline* and *Linking Up* magazines.

That *Cable Television Contractor's Council* is apparently a sub-branch of the *Power Communication Contractor's Association*. This is mainly a national organization for independent CATV operators. They also do seminars and conventions, publications, insurance, and offer safety services.

Several other organizations also do involve themselves with cable in one way or another.

The IEEE or *Institute of Electrical and Electronic Engineers* publishes papers and issues standards.

The *Electronic Industries Association*, or EIA issues standards, especially for communications and interconnects.

And that *Society for Motion Picture and Television Engineers*, or SMPTE is really big on time codes and related production standards.

NEXT MONTH: Don looks at doing independent research of your own choosing.

Cable Magazines

Ulricht's Periodicals Dictionary lists nearly *one thousand* cable and video magazines worldwide. Some of which are free to qualified readers. And that count excludes local newsletters and the underground stuff. You can access this list on the reference shelf of your local library, or else by way of that *Dialog Information Service* on *GEnie*.

A few of these are technical, some are for the advertisers and marketers, some for cable pirates, and some are intended for end users. Let's sample a few of them here...

Communications Technology is the trade journal published by the SCTE. It has solid tech details on operating cable systems, excellent tutorials on fundamentals, and plenty of ads for equipment and services.

They also publish the *Video Services News*. The focus is on FCC regulations, emerging technology, industry gossip, and customer relations. Free sample mini-subscriptions are offered.

Cable Vision deals with the business end of operating a commercial cable service. They're big on programming features, pay-per-view developments, marketing and promotion.

A pair of leading end user satellite guides appear to be *Onsat* and *Satellite Orbit*. These are both *TV Guide* type of beasties which list most of the major networks, superstations, and variety offerings. They are also big on NBA schedules and other sports info.

The cable pirate newsletters tend to come and go. These are available in varying shades of gray. At any rate, five more or less typical examples are *Satellite Watch News*, *Scrambling News*, *Cable Theft Newsletter*, *Secure Signals*, and the *North Star Gazer*.

There are many more of these mags in Ulricht's. A few promising ones I have yet to review are *Broadcasting & Cable*, *The Bullet*, *Cable Guide*, *Cable World*, *Electronic Media*, *Private Cable* and *Satellite Week*.

Cable Networks

There are an amazing number of cable networks out there these days. Paid, public, and user supported. Regional and national. As our first sidebar this month, I've shown a bunch of the high profile commercial

cable networks. These hard-to-locate addresses got summarized from the recent special compilation by *Cable Vision*, called their *Upfront Market*.

Cable Suppliers

The leading old-line distributor of cable tv products is a chain known as *Anixter*, who has warehouses in most larger cities. Competitors advertise in *Communications Technology* and other similar trade journals.

Several of the more obvious cable tv suppliers include *Coast CATV*, *ESE*, and *Spectrum*.

I have found these suppliers to be particularly handy for helping solve a problem I've had with ultra-fringe FM reception. Our local cable company stupidly dropped their FM coverage, so I dropped them. I live in a deep valley over 146 miles from KDKB, the nearest listenable FM station. There's also a 50KW FM random noise source a very few blocks away. And the next nearest station insists on splattering ugly and obviously out-of-spec spurs all over the band.

To beat this, I've found high quality antennas, traps, boosters, filters, and equalizers are available from many cable sources. One good summary of distant FM solutions now appears as HACK76.PS on *GEnie* PSRT. Also see HACK57.PS and HACK67.PS.

Cable Shows

There's quite a few cable-specific seminars and trade shows. A seminar that you just missed was offered by the *Professional Encounter Forums*. You might contact them for a list of future events. One that you still just might catch is *Cable-Tec Expo 94* to be held in the Cervantes Convention Center in St. Louis MO, from June 15-18.

Competing shows are announced in *Communication Technology* and similar trade journals.

Books and videos

Baylin Publications is an outfit who claim they are now the world's largest supplier for the books, software, and videos about cable, satellites, and wireless products. Meanwhile, good old *MIX Bookshelf* has lots of books and tapes on all of those audio and video fundamentals from beginner through advanced. And several fine videos on production techniques are sold by *First Light Video Publishing*.

And, of course, you'll find many ads for fine cable products right here in *Nuts & Volts* magazine.

Fiber Optics and Wireless

Many newer cable systems are now going fiber. A single optical fiber can handle many more channels than can traditional coax. As usual, your best method to get up to date on this is to check out the trade journals.

Two leaders here are *Lightwave* and *Fiber Optic Product News*.

There's also lots of exciting things happening with new wireless bands that are opening up. You will also be seeing direct broadcast satellites and similar user services expanding at an explosive rate. One real winner trade journal here is *Wireless Design and Development*.

Radio World and TV Technology

These are both free and oversize "throwaway" tabloids for the techies involved in radio, cable and television broadcasting. Both of these are very interesting and highly readable.

Radio World is mostly on AM and FM transmitters, production facilities, studio links, older analog, and new digital audio stuff. I got a helpline call the other day for someone seeking a "de-esser". I've never heard of one of these before, but it turns out that a de-esser is an essential filter to keep non-professionals from spitting into the microphone and sounding awful. Sure enough, *Radio World* has several advertisers who sell de-essers.

These folks are also big on RBDS, a tremendous new hacker opportunity. RBDS is a special new subcarrier data service. Its obvious uses are to display the station name and format, the song and singer. Plus weather and traffic and emergency messages. Emerging and hackable commercial uses include new paging services, "coupon radio" bargains that tightly target *only* those listening at any given time, and for making GPS navigation more accurate by broadcasting real time differential corrections.

More background and user circuits for RBDS appear in HACK73.PS and EMERGOP3.PS on *GEnie* PSRT.

TV Technology is a similar mag for cable and television stations. Lots of stuff on cameras, studio links, effects generators, and related oddments. Free to qualified subscribers.

Video Toaster User

Video production has literally been revolutionized by the *Video Toaster* from *NewTek*. You can now produce broadcast quality videos at home at a

new from
DON LANCASTER

ACTIVE FILTER COOKBOOK
The sixteenth (!) printing of Don's bible on analog op-amp lowpass, bandpass, and highpass active filters. De-mystified instant designs. **$24.50**

CMOS AND TTL COOKBOOKS
Millions of copies in print worldwide. **THE** two books for digital integrated circuit fundamentals. About as hands-on as you can get. **$24.50** each.

INCREDIBLE SECRET MONEY MACHINE II
Updated 2nd edition of Don's classic on setting up your own technical or craft venture. **$18.50**

LANCASTER CLASSICS LIBRARY
Don's best early stuff at a bargain price. Includes the CMOS Cookbook, The TTL Cookbook, Active Filter Cookbook, PostScript video, Case Against Patents, Incredible Secret Money Machine II, and Hardware Hacker II reprints. **$119.50**

LOTS OF OTHER GOODIES

Ask the Guru I or II or III	$24.50
Hardware Hacker II or III	$24.50
Micro Cookbook I	$19.50
PostScript Beginner Stuff	$29.50
Intro to PostScript Video	$29.50
PostScript Reference II	$31.50
PostScript Tutorial/Cookbook	$19.50
PostScript by Example	$31.50
Understanding PS Programming	$29.50
PostScript: A Visual Approach	$22.50
PostScript Program Design	$24.50
Thinking in PostScript	$22.50
LaserWriter Reference	$19.50
Type 1 Font Format	$15.50
Acrobat Reference	$24.50
Prog display PS in X	$29.50
Whole works (all PostScript)	$380.00
Insider Secrets & Catalog	FREE

POSTSCRIPT SECRETS
A Book/Disk combination crammed full of free fonts, insider resources, utilities, publications, workarounds, fontgrabbing, more. For most any PostScript printer. Mac or PC format. **$29.50**

BOOK-ON-DEMAND PUB KIT
Ongoing details on Book-on-demand publishing, a new method of producing books only when and as ordered. Reprints, sources, samples. **$39.50**

THE CASE AGAINST PATENTS
For most individuals, patents are virtually certain to result in a net loss of sanity, energy, time, and money. This two volume set shows you tested and proven real-world alternatives. **28.50**

BLATANT OPPORTUNIST I
The reprints from all Don's Midnight Engineering columns. Includes the case against patents, book on demand publishing, toner secrets, paradigm stalking, insider research, lots more. **$24.50**

RESOURCE BIN I
A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. **$24.50**

FREE SAMPLES
Well, nearly free anyway. Almost. Do join us on GEnie PSRT to sample all of the Guru's goodies. The downloading cost on a typical Guru file is **21 cents**. Modem access: (800) 638-8369, then a HHH. On prompt, JOINGENIE. After the keyword prompt, DMD524.

FREE VOICE HELPLINE VISA/MC

SYNERGETICS
Box 809-NV
Thatcher, AZ 85552
(520) 428-4073

Write in 146 on Reader Service Card.

SOME MAJOR CABLE NETWORKS

Amer Disability Chnl
1777 NE Loop 410, #1401
San Antonio, TX 78217
(210) 824-7446

Arts & Entertainment Net
2325 E 45th Street
New York, NY 10017
(212) 661-4500

Black Entertainment TV
1231 31st Street NW
Washington, DC 20007
(202) 337-5260

The Box
12000 Biscayne Blvd, 6F
Miami, FL 33181
(305) 899-9000

Bravo
150 Crossways Park West
Woodbury, NY 11797
(516) 364-2222

The Cartoon Network
One CNN Center
Atlanta, GA 30348
(404) 827-1700

Channel America
19 W 21st Street, #204
New York, NY 10010
(212) 366-9880

CNBC
2200 Fletcher Avenue
Fort Lee, NJ 07024
(201) 585-2622

CNN
One CNN Center
Atlanta, Ga 30348
(404) 827-1700

Comedy Central
1775 Broadway
New York, NY 10019
(212) 767-8600

Country Music Television
2806 Opryland Drive
Nashville, TN 37214
(615) 871-5830

Courtroom TV Ntwk
600 Third Avenue
New York, NY 10016
(212) 973-2800

The Discovery Channel
7700 Wisconsin Avenue
Bethesda, MD 20814
(301) 986-0444

E! Entertainment TV
5670 Wilshire Blvd
Los Angeles, CA 90036
(213) 954-2400

ESPN
ESPN Plaza
Bristol, CT 06010
(203) 585-2000

The Family Channel
1000 Centerville Tpke
Virginia Beach, VA 23463
(804) 523-7301

Galavision
605 Third Avenue, 12th Fl
New York, NY 10158
(212) 455-5200

Headline News
One CNN Center
Atlanta, GA 30348
(404) 827-1700

The International Channel
12401 W Olympic Blvd
Los Angeles, CA 90064
(310) 826-2429

The Learning Channel
7700 Wisconsin Avenue
Bethesda, MD 20814
(301) 986-0444

Lifetime
36-12 35th Avenue
Astoria, NY 11106
(718) 482-4000

Mind Extension University
9697 E Mineral Avenue
Englewood, CO 80155
(303) 792-3111

MTV
1515 Broadway
New York, NY 10036
(212) 258-8000

The Nashville Network
2806 Opryland Drive
Nashville, TN 37214
(615) 889-6840

New Inspirational Network
9700 Southern Pine Blvd
Charlotte, NC 28273
(704) 525-9800

Nickelodean/Nick At Nite
1515 Broadway
New York, NY 10036
(212) 258-8000

Nostalgia Television
3575 Cahuenga BW, #495
Los Angeles, CA 90068
(213) 850-3000

Prevue Channel
3801 S Sheridan Road
Tulsa, OK 74145
(800) 447-7388

Prime Sports Channel
5251 Gulfton Street
Houston, TX 77081
(713) 661-0078

The Sci-Fi Channel
1230 Ave of the Americas
New York, NY 10020
(212) 408-9100

TBS Superstation
One CNN Center
Atlanta, Ga 30348
(404) 827-1700

Telemundo
1740 Broadway
New York, NY 10019
(212) 492-5500

The Travel Channel
2690 Cumberland #500
Atlanta, GA 30339
(404) 801-2400

Turner Network TV
One CNN Center
Atlanta, GA 30348
(404) 827-1700

Univision
605 Third Avenue, F12
New York, Ny 10158
(212) 455-5308

USA Network
1230 Americas Ave
New York, NY 10020
(212) 408-8895

VH-1
1515 Broadway
New York, NY 10036
(212) 258-8000

VISN/ACTS
5619 DTC Pkwy
Englewood, CO 80111
(303) 779-1161

The Weather Channel
2600 Cumberland Pkwy
Atlanta, GA 30339
(404) 434-6800

WWOR/EMI Service
5015 Campuswood Drive
E Syracuse, NY 13507
(315) 433-0022

tiny fraction of the original cost. Full ongoing details often appear in *Video Toaster User* magazine.

NewTek has just added two unique new products. One is their *Screamer* which speeds up computer animation rendering to nearly real time, thus blowing away the fancy workstations. And the other is their new *Video Flyer*, a hard disk based non-linear editing system that completely eliminates any need for most of the horribly priced video production tools.

Free demo videos are now available directly from *NewTek*.

Random Wonderments

Just to round things out, *Morph's Outpost On The Digital Frontier* is a bleeding edge tabloid for multimedia developers. And *Wired*, of course is a stunning new…. Er, then again, its really a superb… Or maybe a really outstanding …. Well, it definitely *is* a must read. Fer sure.

Whatever it is, they are really good at it. Definitely the foremost magazine of its type in the world. Er, in the universe? The galaxy?

This one makes King Kong look like a giant gorilla.

Two traditional film production mags I've found of interest are *Film & Video*, and *Cinema FX*. The latter gem covers special effects in depth. More on special effects in HACK72.PS.

I have posted a large group of other multimedia magazines to HACK71.PS on *GEnie* PSRT.

And, of course, to find any *really* obscure labor-of-love publications, that *Factsheet Five* will honestly and fairly review stuff that is guaranteed to offend pretty near anyone. Their latest issue reviews over 1300 of the alternate press zines.

Finally, the best cable resource of all: *SET Free* is also *The Newsletter Against Television*. Cost is $5 for ten issues. It is published by the *Society for the Eradication of Television*.

This Month's Contest

For our contest this month, just tell me about a cable resource or idea I don't know about. Or else tell me in 175,000 words or less precisely what *Wired* magazine is all about.

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CABLE AND VIDEO RESOURCES

Anixter
8101 E Prentice #210
Englewood, CO 80111
(303) 740-8949

Baylin Publications
1905 Mariposa
Boulder, CO 80302
(303) 449-4551

Black Range Films
Route 2 Box 119
Kingston, NM 88042
(505) 895-5562

Broadcasting & Cable
1705 DeSales Street, NW
Washington, DC 20036
(202) 659-2340

The Bullet
42 Music Square W, Ste 146
Nashville, TN 37203

Cable Guide
309 Lakeside Drive
Horsham, PA 19044
(215) 443-9300

Cable-Tec Expo 94
669 Exton Commons
Exton, PA 19341
(610) 363-6888

Cable TV Contractor
6301 Stevenson Ave, Ste 1
Alexandria, VA 22304
(800) 542-7222

Cable Theft Newsletter
9 Frontier Road
Cos Cob, CT 06807

Cable World
1905 Sherman Street
Denver, CO 80203
(303) 837-0900

CableVision
825 Seventh Avenue
New York, NY 10019
(212) 887-8400

Cinema FX
13120-B Saticoy Street
N. Hollywood, CA 91605
(818) 765-4995

Coast CATV Supply
314 Elizabeth Lane
Corona, CA 91720
(909) 272-2360

Comm Technology
1900 Grant Street, Ste 720
Denver, CO 80203
(303) 839-1565

Dialog
3460 Hillview Avenue
Palo Alto, CA 94304
(415) 858-2700

Electronic Media
740 Rush Street
Chicago, IL 60611
(312) 649-5200

Electronic Indust Assn
2001 Penna. Ave, NW
Washington, DC 20006
(202) 457-4900

ESE
142 Sierra Street
El Segundo, CA 90245
(310) 322-2136

Factsheet Five
PO Box 170099
San Francisco, CA 94117

FiberOptic Product News
301 Gibraltar Drive
Morris Plains, NJ 07950
(201) 292-5100

Film & Video
8455 Beverly Blvd, Ste 508
Los Angeles, CA 90048
(213) 653-8053

First Light Video
8536 Venice Blvd
Los Angeles, CA 90034
(800) 777-1576

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

IEEE
445 Hoes Lane
Piscataway, NJ 08855
(908) 981-0060

Lightwave
PO Box 2139
Tulsa, OK 74101
(918) 835-3161

MIX Bookshelf
6400 Hollis Street, Ste 12
Emeryville, CA 94608
(800) 233-9604

Morph's Digital Outpost
PO Box 578
Orinda, CA 94563
(510) 238-4545

National Cable TV Assn
1724 Mass. Ave, NW
Washington, DC 20036
(202) 775-3550

NewTek
215 SE 8th Avenue
Topeka, KS 66603
(800) 765-3406

North Star Gazer
PO Box 1023
Lapeer, MI 48446
(810) 664-4022

Onsat
PO Box 2347
Shelby, NC 28151
(704) 482-9673

Private Cable
1909 Avenue G
Rosenberg, TX 77471
(713) 342-9826

Professional Encounters
303 E Wacker Drive, #740
Chicago, IL 60601
(312) 938-3500

Radio World
5827 Columbia Pike #310
Falls Church, VA 22041
(703) 998-7600

Satellite Orbit
PO Box 607
Vienna, VA 22183
(703) 827-0511

Satellite Watch News
6599 Commerce #103
Gainesville, VA 22065
(703) 347-7926

Satellite Week
2115 Ward Court, NW
Washington, DC 20037
(202) 872-9200

Scrambling News
1552 Hertel Avenue
Buffalo, NY 14216
(716) 874-2088

Secure Signals
1724 Mass. Ave, NW
Washington, DC 20036
(202) 775-3684

SET Free
Box 10491
Oakland, CA 94610
(510) 763-8712

Soc Cable TV Engineers
669 Exton Commons
Exton, PA 19341
(215) 363-6888

Soc MoPic/TV Engineers
595 W Hartsdale Avenue
White Plains, NY 10607
(914) 761-1100

Spectrum
803 Forest Ridge, Ste 108
Bedford, TX 76022
(800) 628-0088

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

TV Technology
5827 Columbia Pike, #310
Falls, Church, VA 22041
(703) 998-7600

Ulricht's Periodicals
121 Chanlon Road
New Providence, NJ 07974
(908) 771-7714

Video Services News
1201 Seven Locks Road
Potomac, MD 20854
(301) 424-3338

Video Toaster User
21611 Stevens Creek Blvd
Cupertino, CA 95014
(408) 525-0508

Wired
544 Second Street
San Francisco, CA 94107
(415) 904-0664

Wireless Design & Dev
301 Gibraltar Drive
Morris Plains, NJ 07950
(201) 292-5100

Don Lancaster's

RESOURCE BIN

number thirty

Conducting your own personal research.

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I did manage to wrangle a super special signup deal for you *Resource Bin* readers. Ten free hours and zero first month minimums.

By the way, be sure to enter your HHH *immediately* after your modem software reports a connection. This is how *GEnie* recognizes your baud rate. If you get gibberish on the screen, you were too slow with your HHH.

I've also now got a brand new free catalog for you that includes a greatly expanded insider secrets section. Call or write for your copy. Or grab it off PSRT as SYNCAT1.PS. You can also get it via the Internet.

Self-Directed Research

I sure do get lots of calls and letters from you *Nuts & Volts* readers asking technical questions. After a while, it gets obvious that at least some of you don't have the foggiest notion what personal research is all about.

Some claim that they have "looked everywhere" and were totally unable to find anything at all on their subject topic. Or complain about how hard it is to do things in a "remote" area.

Well, their ain't no "remote" no mo, no mo. No way. No how.

Thanks to the magic of any decent modem installed with your personal computer, you can easily do first rate, world-class research from anywhere you want to. Instantly. At any time of day or night. On, beneath, or above ground. So, this month, I thought we might review the main tools needed to find answers to *any* question or the solutions to *any* problem.

The Electronic Hobby Press

Nuts & Volts is obviously a good choice here, but there certainly are a few other good ones. The highest tech pub and the one having the longest history is *Electronics Now*. Traceable clear back to Hugo Gernsback's *Radio World* from the early 1900's.

They also print *Popular Electronics*. While a fine magazine, this is clearly *not* the original PE of Carl and Jerry fame. The original one got Ziffed out of existance long ago.

Probably your finest source for computer-oriented projects is Steve Ciracia's *Circuit Cellar Ink*. Plenty of solidly designed and supported kits here. Another magazine now coming on strong is *Home Power*. A quality labor-of-love publication by Richard and Kathy Perez.

NEXT MONTH: Don looks at emerging opportunities in laser publishing.

For the business aspects of running your own small tech venture, there's *Midnight Engineering*. And the best foreign electronics magazine is still Britian's *Wireless World*.

One important rule: Be sure you go back far enough! The golden age of electronic hobby kits lasted from 1966 to 1973. Incredible products appeared in this era. Really great stuff.

I have found most of the ultra-slick computer magazines to be less than useless. These are all overwhelmingly advertiser driven. They rarely show you how to accomplish anything on the cheap. One big exception is Jeff Duntemann's *PC Techniques*. About the only one that values their readers highly enough to give them bunches of really useful material.

Of the computer news magazines, I subscribe to *InfoWorld*, and *MacWeek*. There is also a *PCWeek* for PC users. I find the daily technology page of the *Wall Street Journal* to be useful.

Trade Journals

It still amazes me how many people never heard of the trade journals. Yet, these remain your first and foremost route to becoming literate in most any technical area. There's over 150,000 *different* magazines and trade journals worldwide. Many of these are free to "qualified" subscribers.

Of the electronic trade journals, the most important four are *E.E. Times*, *Elecronic Design*, *EDN*, and *Electronic Component News*. A complete list is shown in NUTS8.PS on *GEnie* PSRT.

In *any* field, your first and foremost pry bar into any tech area lies in using the trade journals. From the journals, you use the bingo cards to get data books, ap notes, directories, and trade shows. The trade journals are useful to show you what is important and what is not. As well as showing you the mainstream ways of doing things.

Or the latest industry trends.

The best listings appear in *Ulricht's Periodicals Distionary*. You should find Ulricht's on your library's reference shelf, as well as being offered on-line by many services.

The *Standard Periodical's Dictionary* is a close second. And one that does not quite overlap.

One trick: Ask any trade journal

that carries ads for a *media kit* or else a *Sample Copy and Ad Rates*. I call this my SCAR technique. Sometimes it gets you a freebie sub. At the least, it gets you a recent copy. For the price of a phone call or stamp.

Other Library Stuff

There's lots more available in the way of traditional library references. These are also fast becoming available on-line in one form or another.

Ferinstance, there's the *Encyclopedia of Associations*. And the real ancient *Thomas Registry of Manufacturers* that shows you who makes what. But rarely has any up-to-date and useful stuff on smaller hi-tech firms.

My favorite obscure reference work is the *Science Citation Index*. This is the only source I know of which lets you continually find *newer* material!

Here is how it works: Every time someone references somebody else in their bibliography, it ends up in this directory. For instance, *the* horse's mouth paper on active filters is *Sallen and Key*. Anything newer in the field *must* reference this paper or its own credibility will be sorely lacking. Just chase their names forward through time. Then use the *avalanche effect* on repeat quotes from later authors and researchers. *Forward* through time!

The leading publishers for library reference research material are *Gale Research*, *Bowker*, and *Oxbridge*.

Libraries are starting to go to CD ROM "jukebox" data bases. You can easily do fancy referencing and apply keywords six ways from Sunday.

On-line Resources

To me, it does seems foolish to run around to libaries only to find they do not have what you need.

Virtually *all* serious research these days can get done on-line by modem. The libraries themselves are on to this, so most of them now offer their own free local BBS service. At the least, a complete card catalog is included in their menu selections.

Library BBS numbers are not often advertised. You may have to call the library and ask them for info on their BBS access numbers and rules.

As far as *any* serious research goes, today's on-line services are *by far* your most important resource.

The real big one, of course, is the Internet. Now twenty million users and growing. Sources of info and support on virtually any subject. The easiest method to pick up Internet access is by way of a commercial BBS. Most of them are now scrambling to greatly expand their Internet services.

Of the major commercial services, *CompuServe* is the largest and *America On Line* is the friendliest. But my own preference is *GEnie*.

GEnie is widely regarded as having the widest selections of tech library downloads. Around 145,000 library files at last count. They also are well regarded for competent and caring sysops. And are the primary board of choice for fiction writers and sci-fi enthuasists. Among many others.

They are also the lowest priced national BBS at $3 per hour.

Yes, *GEnie* has now upgraded their ancient interfaces, with new Mac and PC versions now available. They also offer ten free trial hours.

There are many tens of thousands of BBS boards up today. Some local; some national. Some are open to all; others members only. Some fee; some free. Many of the larger fee systems have thousands of trunk lines across the country. Fee systems can often be cheaper than distant free ones.

Listings of available BBS systems go out of date faster than they can be printed. You could start with on-line listings on the commercial boards. Or else find *any* local board, and they may list several others.

If you haven't the foggiest how to reach any board in your area, try a local school or computer store.

Of all those BBS services available anywhere ever, one seems head and shoulders above all the others for serious research. This is the...

Dialog Information Service

Which is the ultimate source for *all* information on *anything*. There are hundreds of commercial information providers who offer fee based on-line research services. Dialog is a broker or a supergroup that handily gathers all of these services together.

Services such as *Inspec*, *Compendex*, *Computer Database*, *SciSearch*, and the *MathSci* for computers, technology, science and electronics. *Conference Papers* holding over 100,000 technical entries. The *Geobase* on geography, geology and ecology. Just about every major newspaper as well.

The same *Medline* medical info that doctors use. Stock quotes in real time. Ten million chem abstracts in **C. A.** *Search*. And *Dissertation Abstracts* that include *every* thesis of *every* graduate school. Clear on back to 1861.

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PostScript Reference II	$31.50
PostScript Tutorial/Cookbook	$19.50
PostScript by Example	$31.50
Understanding PS Programming	$29.50
PostScript: A Visual Approach	$22.50
PostScript Program Design	$24.50
Thinking in PostScript	$22.50
LaserWriter Reference	$19.50
Type 1 Font Format	$15.50
Acrobat Reference	$24.50
Whole works (all PostScript)	$380.00
PostScript Insider Secrets	**FREE**
Hacking Insider Secrets	**FREE**

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A Book/Disk combination crammed full of free fonts, insider resources, utilities, publications, workarounds, fontgrabbing, more. For most any PostScript printer. Mac or PC format. **$29.50**

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THE CASE AGAINST PATENTS
For most individuals, patents are virtually certain to result in a net loss of sanity, energy, time, and money. This two volume set shows you tested and proven real-world alternatives. **28.50**

BLATANT OPPORTUNIST I
The reprints from all Don's Midnight Engineering columns. Includes a broad range of real world, proven coverage on small scale technical startup ventures. Stuff you can use right now. **$24.50**

RESOURCE BIN I
A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. **$24.50**

FREE SAMPLES
Well, nearly free anyway. Almost. Do join us on GEnie PSRT to sample all of the Guru's goodies. The downloading cost on a typical Guru file is **21 cents**. Modem access: (800) 638-8369, then a HHH. On prompt, XTX99005,SCRIPT.

FREE VOICE HELPLINE VISA/MC

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Box 809-NV
Thatcher, AZ 85552
(520) 428-4073

Write in 146 on Reader Service Card.

PERSONAL RESEARCH RESOURCES

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

Am. Soc. of Dowsers
Brainers St Box 24
Danville VT 05828
(802) 881-7165

RR Bowker
121 Chanlon Rd
New Providence NJ 07974
(908) 464-6800

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

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

EDN Magazine
275 Washington St
Newton MA 02158
(617) 964-3030

EE Times
600 Community Dr
Manhassat NY 11030
(516) 365-4600

Electronic Comp. News
1 Chilton Way
Radnor PA 19089
(215) 964-4345

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

Electronics Now
500-B Bi-County Blvd
Farmingdale NY 11735
(516) 293-3000

Encyc. of Associations
835 Penobscot Bldg
Detroit MI 48226
(313) 961-2242

Factsheet Five
R Seth Friedman
PO Box 170099
San Francisco CA 94117

Gale Research
835 Penobscot Blvd
Detroit MI 48226
(313) 961-2242

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

High Energy Enterprises
PO Box 5636
Security CO 80931
(719) 475-0918

Home Power
PO Box 520
Ashland OR 97520
(916) 475-3179

InfoWorld
155 Bovet Rd #800
San Mateo CA 94402
(800) 227-8365

Intl Assn New Science
1304 S College Ave
Fort Collins CO 80524
(303) 482-3731

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

MacWeek
One Park Ave
New York NY 10016
(212) 503-4433

Midnight Engineering
1700 Washington Ave
Rocky Ford CO 81067
(719) 254-4558

MIX Bookshelf
6400 Hollis St #12
Emeryville CA 94608
(800) 233-9604

Nuts & Volts
430 Princeland Ct
Corona CA 91719
(714) 371-8497

Oxbridge
150 5th Ave #202
New York NY 10011
(212) 741-0231

PC Techniques
7721 E Gray Rd #204
Scottsdale AZ 85260
(602) 483-0192

Phaedra Enterprises
PO Box 1241
San Bruno CA 94066
(415) 359-0432

Rex Research
Robert Nelson
PO Box 19250
Jean NV 89019

SAE Library
400 Commonwealth Dr
Warrendale PA 15096
(412) 776-4841

Science Citation Index
3501 Market Street
Philadelphia PA 19104
(215) 386-0100

Singing Wind Bookshop
Ocotillo Rd Box 2197
Benson AZ 85602
(520) 586-2425

Tesla Book Co
Box 121873
Chula Vista CA 91912
(805) 646-3371

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

UMI
300 N Zeeb Rd
Ann Arbor MI 48106
(800) 521-3044

Whole Earth Review
27 Gate Five Rd
Sausalito CA 94965
(415) 332-1716

Wireless World
The Quadrant, Sutton
Surrey, SM2 5AS
ENGLAND 01-652-3128

Even the *Foundation Directory* which lists 33,000 organizations which give money away. Employment directories and guides. Business stats.

Dialog offers both a free brochure and directory. To cop this directory, you'll have to pretend like you are going to *directly* subscribe to their big annual service. This directory details hundreds of available data bases.

At first glance, those direct Dialog charges of $2 per minute might seem steep. Until you factor in that "Uh, compared to what?" of wasting a day or more at a distant library.

Dialog charges are now dropping. With practice, you can easily reduce your charges. Dialog is sometimes available cheaper at some libraries or schools or on company accounts.

Dialog is also offered on CD ROM. Giving you free use of older info. But at a high front end cost.

You can play with Dialog on GEnie. Free of any surcharges. They have a special practice area with limited data base coverage. Which is superb for practice or to get the flavor of what serious on-line research is all about. GEnie uses a "cash and carry" rate structure. You pay a surcharge by the search and by the abstract. Rather than a flat hourly fee.

A typical search costs $2.50. I've found *GEnie* cheaper for searching, but my local library is cheaper for the actual abstracting.

UMI

More often than not, if you simply know a paper exists, you are home free. Other times, the abstract may give you enough extra info.

But sometimes you just gotta have the horse's mouth paper.

One method was *Interlibrary Loan*, once available through most libraries. But this service is slow and unreliable. It is also getting dropped by many libraries as a cost cutting move.

The handiest place to get the actual reprint is at **UMI**, who used to call themselves *University Microfilms*. Who stock one each of everything.

But UMI is definitely *not* a research service. To order from them, you must know the *exact* journal name, author, volume, and page.

Charges vary with instant, fast, or routine service.

Patents?

What about patents? Less than one patent in 200 ever shows *any* net positive cash flow. Thus, the majority of patents end up not even remotely useful for anything. I've found patent searches to be a mesmerizingly awful waste of time. Leading you to what flat out does *not* work or is *not* at all economically viable.

And patenteeze is *guaranteed* to rot your mind. Fer sure.

I have *never* found anything really useful when I've read patents. There are vastly more effective places to do research. Lots of them.

Nonetheless, if you think viewing patents may help your quest, you'll find collections of patents in libraries, on CD ROM, and from Dialog's *Patent Abstracts* data base service.

Much more on all this in my *Case Against Patents* package.

Alternate Research

Usually, if you cannot find info on your subject, you are not asking the right questions in the right way. Or are not digging deep enough. Or are searching on the wrong *keywords*. The insiders have a lingo of their own. It is super important to find the keywords they use as early as possible.

There are lots of non-traditional research sources. My favorite of these is that quarterly *Whole Earth Review* and their *Whole Earth Catalogs*. Which focus on honestly reviewed tools.

One interesting alternative is that *FactSheet Five*. A review magazine that covers thousands of the labor-of-love

self-published info sources. Mostly on a mind-boggling spectrum of unusual or controversial subjects. These folks have also previously published their *World of 'Zines* volume. There is stuff here guaranteed to offend just about everyone. Truly bizarre.

Most traditional journals shy away from pseudoscience topics. Recently, I was amazed that Dialog had over 8300 references on *solitons*, a legit and an exciting yet obscure new technology. They now do have nearly a full billion references on line. But in all of Dialog, I was only able to find a mere *seven* papers on dowsing.

But digging deep enough into the Encyclopedia of Associations, I did find *American Dowser* magazine.

More on solitons in HACK77.PS and on dowsing in HACK78.PS.

Several outfits target pseudoscience topics. For instance, *Rex Research* now publishes *Infolios* on most any wierd science subject. These are all low cost stapled Xerox reprint collections. And the *KeelyNet* BBS has to be seen to be believed. Everything from perpetual motion to psychic stuff to UFO's.

Speaking of which, your best guide to the UFO industry is the *Almanac of* **UFO** *Organizations and Publications* published by *Phaedra*. Fat volumes on perpetual motion are now published by that *International Association for New Science*. One competitor is *High Energy Enterprises*.

Specialty Bookstores

In any rapidly changing field, the books tend to be highly overrated.

Your primary choice in info sources should be in the on-line services, the trade journals and industry ap notes. Books place a distant fourth.

As you undoubtedly have found out, most bookstores only carry stuff they know sells. Rather than genuine useful books. And library budgets are severely limited these days.

The place to find out if a book exists at all is in *Books in Print*. Either at your local library, a local bookstore, or on line. They also publish the quarterly *Forthcoming Books in Print*.

Your best place to buy books is in a *specialty bookstore*. An organization that stocks *every* title in a narrow field. And tells you which ones do what.

Your foremost source for the older technical and machine shop books has to be *Lindsay Publications*. Who offers a free pair of fascinating catalogs. A few random samples of the specialty bookstores include the *MIX Bookshelf* on audio and video production, the *Tesla Bookstore*, or the *SAE Library* on automotive subjects.

Here at *Synergetics*, I try to stock the best and most useful of the PostScript books and videos by all authors. If I don't like it, I don't carry it.

My favorite specialty bookstore is the world-class *Singing Wind*, who do focus on southwestern literature and history. This is the only bookstore I know of with an unlisted address. To visit them, you may have to walk on through a pasture of Brahma bulls.

Well, maybe one hint. Just follow Ocotillo Road north out of Benson, Arizona till it feels about right. Then hang right just past the fourth cow.

Don't wear red.

Insider Helplines

A number of outfits offer technical helplines for one reason or another. These may not be advertised. So ask for "tech assistance" or "applications engineering" when you call.

I offer a tech helpline at no added charge over your phone expenses. We also have a *Synergetics Consultant's Network* in which you can be referred to service providers.

Give me a call if you need info on these. US calls only, please.

Others offer developer programs. I am personally a developer for Adobe, Apple, H-P, and a few others. These can offer you insider tech info, loaner machines, and product discounts.

Some are free. Some are bargains. Others are way overpriced. But most are certainly worth the time and effort to persue them.

Local and national user groups are another worthwhile source. Again, you get contacts, discounts, and tech expertise at low cost. You also get the straight story from real product users. Warts and all. Good and bad.

Many years ago, my students and I started up a "just barely real" user group we called the *Gila Valley Apple Grower's Association*. We didn't have any dues or meetings or publications or anything like that. But everybody definitely knew whether they were a member or not. Officer selection was by dictatorial edict. Over the years, we have received all sorts of wildly wonderful benefits. Demos, tech info, discounts, videos, conference invites, and bunches more. Not the least was the VIP treatment Steve Wozniak gave us at the first *US Festival*. Which was California's answer to Woodstock.

Personal networking can be super important. It pays to generate a list of contacts you can call. Contacts who either can give you your answer. Or know someone who does.

Hands on is Everything

No matter what your source, the finest and best research will end up as any you can personally verify. Just do not get in over your head and keep any bias out of your way.

With any circuit diagram or most software routines, it is *essential* that you step into the lab and check things out. By yourself.

More often than not, there will be hidden gotchas which will nail you every time. Should you blindly use or pass on info without verification.

Besides, your own research can often be the most fun of all. And the most rewarding.

This Month's Contest

For our contest this month, just tell me about an unusual resource you have found helpful for doing all your own research. Or about your worst personal research fiasco.

Such as the time I found out that thermoelectric coolers simply do not work. They *heat*, rather than cool! Because of heatsink temperatures.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

For lots more on doing your own personal research, see my *Resource Bin* and *Blatant Opportunist* reprints, the hundreds of files on *GEnie* PSRT. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For fast modem access, use (800) 638-8369 and enter HHH. When prompted, enter JOINGENIE. When asked for a keyword, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM.

Don Lancaster's

RESOURCE BIN

number thirty-one

A "Magic Machine" for desktop publishing.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle a super special signup deal for you *Resource Bin* readers. Ten free hours and zero first month minimums. See the trailer blurb for details.

The "Magic Machine"

Just about any field has a legendary *magic machine*. A device that, while only *slightly* improved over previous stuff, literally turned the corner for an entire industry. Obvious examples are the Model T Ford, the DC-3 aircraft, a RCA 630 color tv, or an Apple IIe.

What really came down is that each of these just happened to be in the right place at the right time. Much of their success was blind luck. All they really did was find a parade and get in front of it. All of the needed bits and pieces already just barely existed in klutzy previous products. But these magic machines just happened to get it all together.

At precisely the time the rest of the technology crossed thresholds that made it all possible.

At long last, the power of the press lies in owning one. PostScript desktop laser printers have long promised to completely blow away traditional jiffy printing. A dream until recently.

Hewlett Packard has introduced their *LaserJet* 4M+. Which I do feel time will prove to be *the* magic machine for all desktop publishing. The first machine which clearly is *cheaper, higher quality, faster,* and *simpler* than any B&W jiffy printing. Besides offering incredibly *better* photo halftones.

At least for 5000 or fewer identical copies. With "internal" economics.

At first glance, the improvements in the 4M+ over earlier machines do not seem that big a deal. But they occur at a magic time when everything else is also finally falling into place.

The 4M+ starts with a proven and well supported *Canon* scanning laser engine. Authentic Adobe PostScript level 2, version 2013. An underlying resolution of 600 x 600 over which a *resolution enhancement technology* is placed that gives a superb final print quality that clearly exceeds nearly all ink-based jiffy printing. Absolutely outstanding photo halftones.

Print speed is 12 pages per minute. A bolt-on duplexer option. Multi trays hold nearly a thousand sheets.

Page device memory compression to greatly ease the amount of memory needed. Full service manuals readily available. So are parts and training. Easily refillable toner cartridges with very good third-party economics. Fast network options. Auto switching.

NEXT MONTH: Don looks at new developments in direct toner printed circuits.

As near as I can tell, there's only one glaring 4M+ defect. A total lack of hard disk or other SCSI support. But that one seems so dumb to me that it *surely* will be soon corrected.

A cost around $1690 street. What is even neater is that you can now *double* your printer speed simply by buying another one! Get five of these dudes for, say $8500 and you could pretty much replace any $240,000 *DocuTech* from *Xerox*. At well under *four percent* of the cost! And minus the hassles.

Let's look at some current resources for desktop laser publishing. We'll see how tech advances make the 4M+ a landmark *magic machine*.

Resolution

How much resolution is "enough"? Early laser printers offered a 300 dots per inch resolution. While clearly better than the dot matrix or inkjet of its time, there were problems with "jaggies", with photo halftones, and with smaller text. On photo halftones, you were severely limited to 37 gray levels at 53 spots per inch, down to a mere 10 photograys at 106 SPI .

Which just barely *missed* being "car shopper tabloid" quality.

But plain old 300 DPI certainly can be improved. Simply by working with the media, rather than fighting it. For instance, most users *still* insist upon using the *seventeenth* most putrid gray available at 300 DPI. You can also pick resolution-friendly fonts (*Stone*) over resolution-hostile fonts (*Optima*). And matching your layout style to what your resolution can handle.

The best phototypesetters offer 2600 DPI. But because jiffy printing is an analog procedure sensitive to such things as dot gain, operator skill, ink balance, humidity, plate quality, run life, and the phase of the moon, the effective perceived resolution of jiffy printing often varies all over the lot. Typically, your final results will only end up around 600 DPI.

The resolution problem is this: For any given technology, doubling your resolution demands *four* times as much memory. Your page makup takes *four* times longer. You'll also need tighter machine tolerances. And potentially *explosive* ultra-fine toners.

Upping to 600 DPI certainly makes sense. The quality improvement over

300 DPI is stunning. You now can get 37 gray levels at a dense 106 spots per inch. Which makes up the difference between bad photos and good ones.

But further "brute force" increases in resolution may not be at all cost or time effective. Instead, you watch out for simple and cheap stunts that can create the *illusion* of higher res. The 4M+ offers several of these.

One is called *resolution enhancement technology*. This is simply a magic and cheap post-processing which smooths out the jaggies by permitting partial sized final dots. With *zero* speed or memory penalty. Very few people can spot any difference at all between a resolution enhanced 600 DPI and a full and true 1200 DPI.

The next one is called *spot dithering*. Traditional printer's halftone spots consist of *one* dot that builds as you go darker into your grays. Instead, you could create *multiple* dots per halftone cell. You get the full gray range of a larger halftone cell, but the virtual grain of a smaller one. This is a 4M+ option that creates the illusion of 120 corrected grays at 106 SPI.

Properly preprocessing your photo images can also add value. Two tricks known as *histogram equalization* and *gamma correction* make sure that you use as many of the available grays as are available. And evenly distribute them over your entire range between black and white. *Adobe Photoshop* is one of many packages which offer image improvement utilities. You can also easily write your own.

Another limitation of not enough grays can be the presence of steps in any gray gradient. A new technique called *error diffusion* easily cures this with some pre-processing.

There's also a true spotless halftone technique waiting in the wings. That uses random fine dots. But these have poor dot gain that tends to favor the darker shades on the 4M+. But you can expect this to be solved.

One trick: If you ever need more res, run everything double size and then photoreduce it. This quadruples your effective resolution.

The bottom line: Before the 4M+, ordinary 600 x 600 DPI printing was "as good as" most jiffy printing. But the 4M+ is clearly better on photos.

PostScript

As we've seen a number of times in the past, PostScript is a totally device independent and fully *general purpose* computer language that happens to excel at dirtying up otherwise clean sheets of paper. PostScript is *the* best method for self publishing.

Most users prefer such PostScript generating application packages as *Pagemaker* or *Illustrator*. But my own preference is to work directly in raw PostScript, which gives me far more flexibility and control. Even if you stick to the mainstream packages, the more you understand PostScript, the better your final results.

The 4M+ is not really a printer. It is really a powerful PostScript general purpose computer that, as an almost inconsequential afterthought, just happens to have this attached print engine. Your 4M+ internal PostScript computer is an outstanding device. It is as powerful or even more powerful than your host machine.

And far more fun to program.

There always appears to be "turf fights" going on over who is to be in control. The host computer always wants to be boss. And the network supervisor always wants to have total say in comm matters. But to me it makes the most sense to *do as many printer related tasks inside of the 4M+ PostScript computer as you possibly can*. Whenever possible, use your printer as a standalone device.

Some PostScript aps generate very slow code. The way to deal with these is to *compile* the PostScript output. The distiller in Adobe's *Acrobat* package is one good solution. Another replaces slow code with page forms.

In any self-collating or on-demand printing, each page gets made up, used *once*, and then erased. On the fly. It is super important to minimize all the page makeup speeds. On the 4M+, typical properly compiled PostScript files will make up and print at the full mechanical speed of the printer. Put another way, the page feeding time is longer than the page makeup time.

More compiling details appear in SPEEDUP.PS and ACRO2EPS.PS.

Hard Disk Options

A local hard disk for a PostScript laser printer is extremely valuable. I would personally say it is *absolutely essential*. These have been routinely sold by *Apple* and *QMS* for years.

One or more hard disks let you operate largely unattended by either a user or a host computer. It very much speeds things up, since 99% of your comm can get eliminated. It lets you store hundreds of fonts.

All document pages can be stored

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on hard disk for instant access. Which turns out to be *insanely* faster than resending your files over and over again. Disk files can also be used for executive or programmable control of the printer. And CD-ROM drives can be added for instant access to images and clip art. Eventually, you'll put all of your demand printing items on a write-your-own CD ROM.

Tricky-to-print pages or images can be converted into instant-print forms and stashed to a disk. Disks are also extremely handy for input logging, file manipulation, and countless other PostScript-as-lanugage uses.

Whenever a PostScript printer first gets turned on, each of the characters used in each and every size has to get converted into a bitmap. This file of bitmaps is called a *font cache*. Font caching is very slow, compared to the actual character reuse.

With a hard disk, the font cache is more or less permanent. Thus, hard disks can eliminate any speed penalty every time you turn your printer on or off. Hard disk caches can also be used for forms and patterns.

You also end up with much more useful memory in the printer, since you do not have to stash downloaded fonts and other VM-gobbling code directly in the printer. This extra free memory lets you run fancier jobs (or more poorly written ones!), improves network comm, prevents most odd VM blowups, and lets you run full duplex and auto jam recovery even at full legal page sizes.

And, of course, network traffic is dramatically slashed when you use a local hard disk.

There are several workarounds to a hard disk. PostScript level II permits strings as file objects. So you could persistently download the strings in main memory as a way of faking disk files. Level II also has a strong *forms* capability. For multiple runs, you can just download forms and then reuse them. There was a bad bug in early level II machines that prevented you from using forms and multiple trays at the same time. This has apparently been eased in the 4M+.

More info in FORMSBUG.PS.

As with a duplexer, the hard disks should be a snap-on option added to a standard machine.

Recharging Economics

The original idea on desktop laser printers was that all the stuff that goes bad gets put into one "throwaway" cartridge. The cart would hold a fresh toner supply, mag transfer rollers, a charging scheme, an imaging drum, and a spent toner holding tank. Most maintenance problems would vanish. And the manufacturers would make a fortune since they'd retain control.

The only little oint in the flyment was that playing "by the rules" turned out to be outrageously expensive.

Your per-sheet toner costs could easily exceed a nickel per page side.

And *completely dominate* your long term economics.

It did not take hardware hackers long to discover that you could refill these carts, dramatically and forever changing laser printer economics. A $115 cart can often be refilled for as little as $4.50 in a simple two-minute process. And getting the toner costs down around 0.2 cents per page side. *Cheaper* than jiffy print ink.

And the crucial key to profitable small scale or home printing.

The manufacturers responded to this by making the drum wear out shortly after one cycle. One trick was to use excessively abrasive toner. To which hardware hackers added third party hard drums. And a "pixie dust" drum lubricant poweder coating.

The toner wars continue. The latest bad-guys trick is to provide postpaid "recycling packages" whose real goal is to get all their carts back and thus *prevent* cheap and convenient local third party recycling. This is blatant ecopornography of the vilest sort. To which the hardware hackers respond by shipping bricks back in the prepaid recycling packs.

At long last, the 4M+ uses a fairly easy-to-recycle cartridge. Sometimes you can get away by just pouring new toner in through a convenient cap. At least for your first refill. Otherwise two screws and two plastic dogs field strip the cartridge, letting you access the imaging drum and the spent toner holding tank. With care and a third party hard drum, you can easily get dozens of refills per cartridge.

You do have to use fine grain toner in the 4M+ if you are to achieve full resolution. Picking the wrong or an inefficient toner may also quickly fill the spent toner holding tank.

Ads for recharging materials and supplies appear in *Recharger*. A great source for laser printer rebuild kits, training, and parts is *Don Thompson*.

Recharging info on the EX cartridge used in the 4M+ does show up in the August 1994 *Electronics Now* and also as HACK79.PS on *GEnie* PSRT.

Duplex Printing

A *duplex printer* prints on both sides of the page. Duplex printers can be automatically self-collating. Just what you'll want for either newsletters or Book-on-demand publishing. They also use much less paper.

Duplex throughput can be vastly higher. They are far more operator friendly, and there is ridiculously less scrap. Any error on a duplex book trashes one easily replaced page. The

same backside error done on a regular printer destroys most of the book.

Once you've used duplex printing, you will *never* want to go back to a simplex only printer. Ever.

A true duplex printer would need *two* imaging stations. Instead, a laser printer will print one side, route the page back down through a *switchback* mechanism and then print the other side. The trick is to *interchange* your leading and trailing page edges.

To speed things up while the page is going back around, *pipelining* gets used on longer jobs. Thus, a typical duplex page printing sequence is 2 - 4 - 1 - 3 - 6 - 8 - 5 - 7. Surprisingly, duplex printing can be just about as fast as simplex printing.

Extra memory is needed in duplex modes, especially when using auto jam recovery. This is greatly eased in the 4M+ which uses a new hardware page device compression scheme.

There are two ways you might like to print a duplex page, called *normal* and *tumble*. Normal mode is used for ordinary full size portrait books and newsletters. Tumble mode is used for calendars or folded pages.

Duplexing laser printers are not yet common. The usual chicken-and-egg problem of way too few of the end users knowing how great they are.

And to some apparent industrial politics and machine use restrictions. Ferinstance, the older *QMS* Turbo 820 printer has all the empty space and brackets and bolts for an internal duplexer. But no duplexer was ever offered for sale.

Two common early duplexing laser printers were the *Hewlett-Packard* 2D and 3D. Because these were different from their higher volume LJ2 and LJ3 parents, a fairly stiff cost premium was involved. And very few sold.

The obvious solution was to make the parent printer support a bolt-on or a *slide-in* duplexing mechanism. This way duplexing can be cheaply added to a high volume, low cost parent machine. At current costs around $600 list and $400 street. Third-generation duplexers should be much cheaper.

They are really nothing but some power rollers, a one-turn clutch or two, some bent metal, and a small brain-dead microcontroller.

The *Hewlett Packard* 4SiMX was one of the first higher volume mid-range lasers to use a slide-in duplexer. HP has graciously loaned me one of these, and their duplexing performs nearly flawlessly. The slide-in mechanism inserts in a slot underneath the main printing path. Switchback gets done as the page goes out the front under the paper trays and then reverses.

While not quite as fast, rugged, or as easily maintained, the 4M+ offers most of the performance of an older 4SiMX at less than half the price. For self-collating BOD printing, the 4M+ faster PostScript page makeready time largely negates the 5 PPM feeding advantage of the 4SiMX.

More on the 4SiMX in HP4SIMX.TXT on *GEnie* PSRT.

The 4M+ has promised a low cost bolt-on duplexer "real soon now". I have yet to see one. It will snap onto the back of the machine.

Toner Durability

No, toner is not yet as durable or as flexible as ink. But it is more than good enough for typical users. And specialty third party toners exist for such things as ultra-black graphics, printed circuit direct etching, MICR magnetic check printing, the direct transfer decals, and T-shirt thermal transfer printing. Other exciting new toners wait in the wings.

Two nasty toner habits: vinyl may leach toner. So a toner image might stick or transfer to a premium page protector or your new white couch. If you ever get toner on your clothes, be sure to wash them in *cold* water.

Heat permanently sets the toner.

There's several ways to increase the toner's durability. One is *Bakerizing* where you place toner in contact with a thin sheet of mylar and apply heat and pressure. The toner will calender, and turn into a durable jet black of a very high gloss.

You have to see this to believe the results. Especially on business cards.

Kroy Color or the other hot stamp effects can also improve appearance and durability. But products remain outrageously overpriced here.

Another route is lamination, where you lock in your toner underneath a plastic sheet. This is especially useful for menus and book covers. One low cost source is *USI*. Another possibility is a hybrid route that jiffy prints your covers or high wear areas and uses BOD for the rest. The best and most flexible binding scheme I've found is the *Pentabind* from *Unibind*.

Artists fixative sprays aren't that great, since they tend to diffuse the toner and smear badly. But there's an absolutely wonderful new *Laser Buddy* product that literally is Bakerizing in a can. You spray it on, and the toner gets blacker and more glossy. About $8 per can. I routinely use this great stuff for all camera-ready work.

Three tips: Be certain to use Laser Buddy outdoors in a well ventilated area. And avoid thumbprints while drying. Wait at least an hour before using page protectors.

What about color? You could get color toner carts for such things as spot color or special effects. But they don't really look that great, they are hard to find, and are expensive.

There are bunches of new full color laser printers coming on line, with prices in the $6000 to $9000 range. But this whole field is still up for grabs. I don't expect the color magic machine to arrive for a few years yet.

For More Info

More info on the 4M+ is available from *Hewlett-Packard*. The separately purchased repair manuals come from *HP Manuals*. And info on becoming a printer developer is available through *HP Peripherals Group*.

The best street pricing on HP laser printers usually shows up in *Computer Reseller* magazine. You can also check *InfoWorld* and *MacWeek*.

More on durability solutions and unusual toners from *Recharger*, from Frank Miller's *DynaArt Designs*, or in TONERTRX.PS on *GEnie* PSRT.

For more on PostScript, start with Adobe's red and blue books, and my STARTUP.PS and SPEEDUP.PS files on *GEnie* PSRT. More on BOD publishing appears in my *Book-on-demand* kit, per my nearby *Synergetics* ad.

Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

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You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM.

Don Lancaster's

RESOURCE BIN

number thirty-two

Direct toner homebrew printed circuits.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (602) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle a super special signup deal for you *Resource Bin* readers. Ten free hours and zero first month minimums. See the trailer blurb for details.

Prototype printed circuit boards from traditional service bureaus have gotten outrageously expensive. It's not uncommon to have to pay $300 for a few copies of even simple designs.

As an alternative, there have been some dramatic improvements in the *direct toner* printed circuit prototyping method. Schemes all based on the fact that laser printer toner makes a fairly decent etch resist when it is properly bonded to bare pc material. Giving you prototype circuits done at home in minutes for pennies.

Besides incremental improvements, the big news is the new *total* direct toner system from *DynaArt Designs* that includes *everything* you'll need.

Traditional Suppliers

We looked at photographic and silk screen printed circuit boards back in those *Resource Bin* reprints and up in NUTS3.PS on *GEnie* PSRT.

As a brief summary, *Kepro* is your leading source of traditional materials and supplies. Including etchers and etchants, precoated boards, shears, drills, and even plating setups.

The main trade journals for printed circuit production do include *Circuits Assembly*, *Printed Circuit Fabrication*, *Circuitree*, the *Printed Circuit Network*, *Electronic Packaging and Production*, *Printer Circuit Design*, and *Electronics Manufacturing*.

Shears useful for cutting pc boards are ridiculously expensive. Be sure to analyze your "cost per cut" before you buy one. Alternatives include barter at your local sheet metal shop or a table mounted router.

Kepro does sell the most popular board shear. One tip on using it: Glue two small mirrors on the top of your workbench and do your cutting *upside down* for best accuracy.

Two high profile sources for the silk screen method supplies now include *Advance Process Supply* and *Southern Sign Supply*. The leading trade journal here is *Screen Printing*.

TEC-200 Film

The first direct toner product was the TEC-200 film from *Meadowlake*. A pioneer transfer scheme now largely obsolete. More people swore at this product than by it. Even though many problems were their own fault.

This one was apparently something similar to a slip-coated type-D mylar polyester film. Toner was transferred to the film and then heat transferred from film to the pc board. The crucial problem was *differential transfer*. Only a portion of the toner ever made it all the way. Dropouts were endemic.

NEXT MONTH: Don looks at useful optoelectronic and fiber optic resources.

This early film did prove several things. Plain old copy machines just won't hack it. Why? because few copiers are exactly 1:1. You are likely to short pins on long edge connectors and such. And because you'll have limited control of toner density and quality. Or of the amount of fuser oil ending up on the film.

Instead, you want to use a known PostScript laser printer, preferably based on a *Canon* SX engine and with a temporarily dry fuser wand. Full of carefully chosen toner.

Ads for suitable toners appear in *Recharger*. My current favorite toner source is *Static Control Components*. For SX machine servicing and repair parts, try *Don Thompson*.

Second, the bare boards have to be squeaky clean. Any properly cleaned copper is not copper color at all; it is instead a hot pink. And will support a freely flowing and *unbroken* water film. At the very least, half an hour of scrubbing using *Comet* or a similar chlorine-based cleanser is needed.

Third, a plain old iron also won't hack it. The hot transfer of toner must take place *briefly* and precisely at 375 degrees F under high pressure. The best way to do this is with contact pressure from a hot roller device such as a *Kroy Color* machine or clone. Or a reworked laser fuser assembly. Other possibilities are T-Shirt heat presses and modified laminators.

Fourth, even the best of properly transferred toner is somewhat brittle and fragile. A fairly gentle etching is required. Most users tried to use low temps and the ferric chloride etchant. Which ridiculously lengthened your etch times and undercut.

The only reasonable etchant to use is ammonium persulfate; the proper etching temperature is around 118 degrees. You can easily hit this with a yard sale warming tray.

DynaArt Designs

Two firms have recently attacked the differential transfer problem, and both came out with second generation

direct toner transfer films.

Frank Miller of *DynaArt Designs* has elected to go the water soluble route, similar to ordinary decals. His film has a coat of a high temperature but water soluble glue.

You can fake his material by using premium art store white glue applied with a windshield wiper blade. But it is far faster and simpler to use the genuine article.

As before, the film gets sent through a suitable laser printer and the *reverse reading* toner image is put down. Also as before, temperature and pressure is used to bond the toner to a properly cleaned pc board.

Instead of peeling the backing away and getting a differential transfer, you instead soak the board in water. This releases the glue coating. The backing sheet floats on away. Eliminating one source of differential transfers.

Etching proceeds as usual.

As a bonus, the material can also be used to create ordinary toner-based decals. Three thin coats of lacquer are sprayed onto the transfer sheet. The images are cut, soaked in water, and applied just like regular decals.

While not at all suitable for printed circuits, this method is outstanding for dialplates, for front panels, and especially for all model railroad stuff. With a modern laser color copier, the results can be totally stunning. And a 600 DPI laser printer can do HO gauge train lettering that is smaller than a scale one inch high.

DynaArt has gone well beyond a simple transfer film. They've now got an integrated line of everything you will need for full direct toner printed circuit production. They've got a very gentle *wave etcher* that is optimized for their fairly brittle toner resist. Plus a new laminating machine that applies the proper heat and pressure for an optimum transfer.

Properly reloaded cartridges full of tested SX toner are also offered. So are reload toners and removers.

There is also a circuit board drill. Plus a well made (but rather pricey) Swiss machine that is a combination shear and brake. Also storage cases, retouchers, magnifiers, and etchants.

Techniks

Meanwhile, the folks at *Techniks* decided to attack the bad differential transfer problem by applying a blue polymer to their transfer sheets. This polymer was selected to strongly hold toner. But only loosely bond to either the backing carrier or to itself.

As before, a negative image is put down and then thermally transferred. Your backing sheet gets peeled away, transferring the toner *and* the polymer to the pc board. The polymer acts as a second defense against pinholes.

In a competitive response to the *DynaArt* system, Techniks now also offers water soluble transfers.

Bit Bangers

Is there any way we can simply put the toner directly onto the pc board copper? Without using any transfers at all? This is called the *direct copper method*. While serious problems still remain, there are two new products that let you explore this.

What are the big problems? First, a normal printed circuit board is much too thick to send through any stock laser printer. Especially those lacking simple paper paths. The way to beat this is with peel-and-stick foils.

Second, the foil materials are very expensive, so you need some way to send presized *smaller* pieces through the printer. This is best done using some sort of a full size carrier.

Third, laser printing works because of an electrostatic process. It cannot put toner onto a large conductor. A partial solution that seems to work is to put a thin dielectric coating on the foil before sending it through.

Even with a dielectric coating, I am mystified how the main laser corona charging can do its thing with a big old floating ground plane in the way. But the process *does* seem to work.

Potential advantages of the direct copper method are its simplicity, the elimination of differential transfers, and easy registration for double sided step-and-repeat boards.

There are now two products which do address the direct copper method. Both are still experimental. But these seem destined to eventually hit the big time. And you just might like to play with them.

I'm not even sure the first product exists. A few years back, the *Sheldahl* people sent me several carrier based sheets of their peel-and stick copper intended for inside use on multi-layer boards. At the time, this was a back lab project in the "solution seeking a problem" class. You can contact them directly for more info.

Meanwhile, David Durant up at *Bit Bangers* has taken a similar source of peel-and-stick copper and applied a thin white dielectric coating on it. You

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Irvine CA 92718
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run this through a laser printer that has a reasonable paper path.

The *Canon* SX engine as used on the LaserJet III or the LaserWriter G is a good choice. Naturally, you leave the printer's rear door open.

The toner somehow still transfers to the dielectric coating, even with the humongous old floating ground plane between it and your corona charging wire. After imaging, the fusion rollers bond the toner to the copper.

Next, you stick the foil to a suitable substrate, say 1/16" bare fiberglass or polyester. You'll then use an alcohol soaked wipe to remove the dielectric coating. It's very important to be sure you totally remove *all* of the dielectric coating, since the coating is itself a good etch resist.

Unlike all the hot transfer methods, you will want a *normal*, rather than a *reverse* image. The toner pattern *is* the etch pattern. But your second side art *may* need reversed, depending on the software. Copper remains where the toner is present.

The early prototypes I tested had a fragile and a scratch-prone dielectric coating and no provision for smaller size feeding. Both of these problems should have been eased or eliminated by now. Yes, small quantity kits are newly available. Multi-layer boards seem a definite possibility here.

A Spray-on Solution?

I've recently discovered *Laser Buddy* document spray. This stuff instantly upgrades just about any toner image, making it blacker, glossier, and more durable. It is nearly essential for any camera ready artwork.

Around $8 per can.

Sadly, Laser Buddy is not directly usable on pc boards. Because of their acetate solids that get put down on the areas to be etched.

But a related product that sprayed only solvents and no solids might just improve things bunches. Your toner would temporarily soften, absorbing many pinholes and any tiny defects. Sort of an "annealing" process. And one that might be later combined with extra heat and pressure.

Another possibility is that laser thermography spray-on material from *Bennet LaserBrite*. Its intended use is to soften toner long enough to let you sprinkle on thermography powder.

After heating, the powder swells, giving you the "raised print" effect needed for premium business cards or Braille messages.

Neat stuff.

Plate Thru Alternatives

The big boys often will use double sided boards having plated through holes. I know of no simple and cheap plate-thru process.

Many components are now offered in surface mount options. These can greatly reduce the need for holes.

Eyelets are one solution, but these are so klutzy as to be nearly useless. *Stimpson* is the usual source.

The cheapest hack is to use a plain old wire, soldered to top and bottom. One tip: Use a long wire as a "handle" and then cut it off after soldering. You can also use component leads.

But my favorite solution for one-up prototypes and short runs is to use machined contact pin sockets. These fit a very small hole and can be easily soldered both sides. You plug ic's or other components directly into them. *Mill-Max* and *Molex* are two of many sources. The new *compliant* pins are best since they stay put.

Meanwhile, full plate-thru labs are available from *Kepro*. With the prices starting around $10,000. Around 25 painful steps are involved in making a true plate-thru board. Several very hazardous materials and other nasties come with the territory.

The Other Side of the Coin

In this day and age, photocopying printed circuit patterns in a magazine makes no sense whatsoever. You will always end up with a fifth generation image that is just about guaranteed to have pinholes, clearance hassles, and final size errors.

Instead, it makes far more sense to directly offer your first generation pc artwork via a disk or a BBS service. I have long been offering this on *GEnie* PSRT, but others have been slow to pick up on this major new hardware hacking breakthrough.

I've found that by far the simplest, cheapest, fastest, and most device independent file format is to use a PostScript .EPS file. The trick is to *compile* your code. This gives you a

fast and compact image-only runtime code. One that retains no trace of any proprietary layout packages.

The easiest ways to distill include DISTILL.PS on *GEnie* PSRT, or else a distiller offered in Adobe's *Acrobat*. Acrobat is really great. Especially for screen previews. But it does place a burden on your end users who'll need special reader software. But you can simply extract the Acrobat objects and convert them to .EPS files.

More on this in ACRO2EPS.PS on *GEnie* PSRT.

This type of .EPS file should run on any PostScript printer. Even on the most abysmal of clones. You also have the option of using *any* laser printer and that *GhostScript* shareware. This also gives on-screen previews.

GhostScript is available from many on-line services, including PSRT.

For a limited time, freebie Acrobat readers are offered by the TAX board on *GEnie*. But you cannot redistribute these uniquely coded files.

I'll be most happy to help you make up your own .EPS pc files. Give me a call if you need assistance.

This Month's Contest

For our contest this month, just tell me about anything that can make the direct toner method even better than it is today. Especially any solutions towards multilayer and plate-thru.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (602) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For fast modem access, use (800) 638-8369 and enter HHH. When prompted, enter JOINGENIE. When asked for a keyword, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM.

Don Lancaster's

RESOURCE BIN

number thirty-three

Optoelectronics and fiber optics goodies.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (602) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle a super special signup deal for you *Resource Bin* readers. Ten free hours and zero first month minimums. See the trailer blurb for details.

This month, I thought we'd wander in and about the infrared, visual, and uv portions of the spectrum. With our usual focus on new neat stuff...

Frequency and Wavelength

There really isn't much difference between radio, infrared, light, and the ultraviolet. All of these can be treated as electromagnetic waves which obey Maxwell's laws. They travel at the speed of light in a vacuum. And a tad slower in most of the real world.

Any electromagnetic wave has its *wavelength*, defined as the distance it takes the propagating wave to return back to a repeating *phase* or reference point. Related to this wavelength is that wave's *frequency*, which is simply how many full lumps of the traveling wave pass by per second.

Radio waves are relatively low in frequency. These are followed by the submillimeter "mystery" waves, then infrared, light, ultraviolet, X-rays and cosmic rays. All in order of increasing frequency. In general, higher energy levels are associated with the higher frequency bands.

An AM radio station might have a 1 MHz frequency and a wavelength of 300 meters. For FM, maybe 100 MHz and 3 meters. A traffic radar, 10 GHz and 30 millimeters.

As you get into higher frequencies, you tend to measure in wavelengths only. Your current optical standard is the *nanometer*, which is one billionth of a meter. This has replaced the ten times larger *Angstrom*.

Both of which appear kinda tiny. Except that today's integrated circuits routinely deal with distances in the 400 nanometer (or 0.4 micron) range.

Which is well *beyond* what you can achieve using ordinary light.

The current upper limit of the radio *microwave* spectrum lies somewhere around 300 GHz. With a wavelength of one millimeter. Which equals one million nanometers.

Above microwaves is what I'll call the *mystery band*. The very same area the radio astronomers often refer to as *submillimeter wavelengths*. This one runs from 1,000,000 nanometers down to 33,000 nanometers. An astonishing spread of 30:1 in frequency!

To give you a feel for the vastness of the mystery band, there's enough room for 1,452,000 tv channels!

The mystery band is largely virgin territory. A few radio astronomers do lurk here. So far, there have been no really good and low cost detectors, amplifiers, and oscillators. Not to mention test instruments. And heat sources and rain make for big time problems. But recent nanotechnology developments should soon "open up" this exciting new area.

NEXT MONTH: Don looks at some new developments in remote control circuitry.

Best of all, though, is that this mystery band is totally unregulated and licence free. The FCC regulations appear to stop at 300 GHz.

Mystery band insider secret info appears in the *International Journal of Infrared and Millimeter Waves*. But not as an easy read.

Just past the mystery band is the *infrared* or "heat band". Usually split into *near infrared* from 800 to 6000 nm. And *far infrared* from around 6000 to 33,000 nanometers.

The "near" and "far" here will get measured with respect to normal light frequencies. Note that "near" infrared is at the *upper* ir frequency range but that "near" ultraviolet is at the *lower* uv frequency range.

The far infrared is the home of *black body radiators*. Most any object not at absolute zero emits a broad spectrum of energy. The higher the temp, the higher the energy's center frequency. For instance, a warm human body at 293 K has a peak heat wavelength of 8000 nm. A 2800 K photoflood peaks clear up in the visual.

Far infrared uses do include people detectors and snooperscopes. Near IR is used for fiber optic comm, remote controls, optocouplers, environmental photography, and position encoders.

The visible portion of the spectrum is only an octave wide, running from 800 nm deep red up to 400 nm blue.

Following that usual ROY G. BIV rainbow sequence. The response of the human eye varies greatly over this range. To perceive a white light, a mixture of *one* part red, *three* parts green, and *two* parts blue are often used in combination.

Ultra-violet literally means "beyond purple", involving frequencies above the visual. "Near" or "soft" ultraviolet sources can be used for such things as posters and fluorescence effects. "Far" or "hard" ultraviolet is used to erase EPROMS, for germicidial lamps, flame detectors, and for mineral studies. 225

nanometers often is used by EPROM erasing machines.

Warning: Hard ultraviolet can cause irreversible eye damage.

Gamma and X rays are even higher in frequency. Above and beyond uv.

The Mother Lode

If you are gonna talk optics, you gotta start with the *Edmund Scientific* catalog. Except that *American Science and Surplus* is generally far better on all counts. Especially their bargains. The big boys use such pricey old line sources as *Rolyn Optics.*

There are quite a few optical trade journals. Some of the more general include *Advanced Imaging, Photonics & Optoelectronics, Optics and Photonics News* and *Photonics Spectra.*

The best association appears to be the *SPIE.* They publish lots of papers, tutorials, and conference papers, the *Journal of Electronic Imaging, Optical Engineering,* plus lots more. Their free catalogs form an outstanding index of hacking possibilities.

A more traditional scholarly group is the *Optical Society of America,* who also publish *Applied Optics.*

And, of course, *Scientific American* has been known to run a hacker optics project every now and then.

Those optoelectronic data books are offered by most of the semi houses. The obvious leader is *Hewlett-Packard.* Whose giant and free *Optoelectronics Designers Catalog* is a must have. Some others are *Hitachi, Marktech, Siemens, Motorola, Texas Instruments, Quality Technologies,* and *Sharp.*

People Detectors

Let's first wander off into the far infrared. People detectors are based upon human ir signatures. The fancy chips are called *pyroelectric detectors,* with both *EG&G Heimann* and *EG&G Judson* being premium sources. One much cheaper alternate is *Kynar Piezo Film* from Amp. They even stick free samples on their data sheets.

Another gotta have. And one of the greatest hacker components anytime, ever. Senses heat *or* motion.

Note that far ir sensors are basically capacitors. Thus, they can only sense *changes* in temperature radiation. The older way around this gotcha was to put a spinning fan blade or a vibrator in front of the detector to chop up the beam. The new way is to add a *Fresnel* lens which purposely has "hot" and "cold" spots on it. As a person crosses the beam, the detector sees a changing signal and then responds.

Please pronounce it right. As in "fir-nell". Like the tree and the girl.

Since any ten cent hot-cold Fresnel lens involves a zillion bucks worth of advanced optical engineering, you're far better off picking up any old stock occupancy detector from your local electrical supply warehouse. Because of a recent California law mandating these for new buildings, they only cost $12 or so. And are quite easily modified. *Leviton* is one brand.

More on these in HACK32.PS and in the *Hardware Hacker III* reprints.

A video on infrared video cameras for surveliance, security, and energy monitoring is avialble from *Infracam.* Lots of infrared temperature devices are offered by *Omega.* Or by ads in *Sensors* or *Measurement & Control.*

An ultra simple phosphor based ir monitoring card is stocked by *Radio Shack* for the convenient testing of ir remote controls. *Plessey* and *NEC* are leading suppliers for ir remote control chips. *Reticon, Kodak,* and *TI* are all good sources for hi-pixel line and area sensors, infrared and visible.

You can contact them directly for more details.

Lasers

A laser is just a high tech light bulb. All they do is emit one *monochromatic* single color of light. Sometimes, they will also emit *coherent* light that has a unified phase front. Coherent light is usually essential for holograms and interferometers.

The most popular older device was the helium-neon laser. But these have recently been shot out of the saddle by solid state laser diodes. Which are cheaper, smaller, more rugged, last longer, use infinitely more convenient supply voltages and are vastly more efficient. Especially for "red string" uses where you don't really need full coherence. Or for near infrared uses (such as CD-ROM readers) where you don't have to see the beam.

Two tips on the solid state lasers: Watch the wavelength carefully. A 790 nanometer diode is just barely visible in a totally darkened room. But may be available surplus for under $5. And a cheap way to test new ideas.

Of the really red diodes, the 630 nanometer ones seem much brighter than a 670. Owing to a really steep visual dropoff.

Also, the usual input power needed to lase is just under the self-destruct power. So, you *always* must run any

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laser diode *closed loop*, using feedback from an internal light sensor. Fail to do this, and you are *certain* to blow a laser diode. Every time.

The really big laser news is the ML-211 laser pointer from *Metrologic*. Only $39! Which makes all sorts of "red string" apps newly cost effective. Such as lecture pointers, construction levels, and light shows. The latter done by bouncing your beam off a mirror glued to a speaker.

The spot size is around an inch at thirty feet. It can be further improved with additional optics.

Your best two sources for low cost and surplus laser devices are *Meredith Instruments* and *MWK*. These outfits also get into ir viewers. Meredith even has a light show BBS.

Besides some good columns right here in *Nuts & Volts*, your best laser reading often appears in the *Industrial Laser Review*, in *Lasers and Optronics*, the *Journal of Laser Applications*, *Laser Focus World*, or *Laser Tech Briefs*.

By the way, surprisingly little laser power is required to do real world tasks. Owing to the concentration of beam energy. For instance, a twenty watt carbon dioxide laser is all you'll need for the precision cutting of such items as dollhouse furniture or model railroad structure parts.

And you often don't have to tow the laser around. Often, you can use mirrors to move the light to where you want it. Hint: Use large *defocused* beams to keep your power density down at the mirrors.

Fiber Optics

Light obeys *Snell's Law*, which says it turns toward the denser or more refractive media. You can easily create *light pipes* that have a property called *total internal reflection*. An *optical fiber* is a light pipe that transmits nearly all the input light to its far end.

The pipe can be a few feet long for a gee-whiz stage or design effect. Or it can be many miles long, transmitting networked data across a campus or around the world.

The whole field is called *fiber optics*.

There's two types: The only goal of lower cost *noncoherent* fibers is to transmit light energy from one end to another. A single fiber does have an incredible bandwidth, easily carrying

thousands of phone channels or dozens of high quality tv signals. It is also reasonably secure, although you *can* "sniff the fumes" off a slightly bent fiber. Sneaky.

You'll also find the more expensive *coherent* fiber arrays that can actually preserve an image and recreate it at a distance. For use as scanners, copiers, medical diagnostics, and for use in industrial inspection. *Olympus* is one source for fiberscopes.

You should be able to find lots of ads for fiber optic stuff right here in *Nuts & Volts*. To get into the subject further, see *Fiber & Integrated Optics*, *Fiber Optic Product News*, and the new *Lightwave* trade journal.

Solar Electricity

There's a lot of hacker interest in solar energy. But disillusionment sets in real quick like. Just as soon as you discover that real world solar energy systems are (A) diffuse, (B) inefficient, and (C) expensive.

In fact, the realities of solar have gotten so bad lately that one of the largest solar sites in the country was recently chopped up and sold at a yard sale. It was more profitable to *retail* used cells to hardware hackers than to generate electricity.

Sad but true.

Most government solar subsidies are now long gone. So are the scam artists that came with the territory.

On a bright sunny afternoon here in Arizona, there's around 1200 watts per meter of incoming energy. Silicon solar cells have an absolute efficiency limit of 26 percent, set by the fact that only one wavelength of light has got exactly the right energy "packet" size for efficient silicon conversion.

Real cells have an efficiency around nine percent, but reduced by area and interconnects to, say seven percent or less. Which leaves you with around 72 watts per meter. But that is in the afternoon only. The 24 hour average is more like 24 watts per meter.

Of course, that's at the *input* to your battery storage and inverters. When you allow for inefficiencies, you'll be lucky to do better than 19 watts of *delivered* electricity per square meter of solar array.

Then again, an average house roof can convert more electricity than gets used underneath it. And by going to *cogeneration* schemes where you also heat water or living areas, all of the numbers get a lot better. And micro power solar (for calculators and such) definitely works like a champ.

Your best source for "them that's doing" solar info is *Home Power*. The competing *Home Energy* magazine is not nearly as good. And I've found *Solar Today* to be nearly useless.

Three resources for innovative and useful solar products are *Real Goods*, *SolarJack*, and *Zomeworks*.

I personally feel that "amorphous" and "polycrystalline" silicon solar cells are a cruel joke. Because of their low efficiencies and their unreliability.

There's some exciting new solar electricity developments still in the labs. I do expect some revolutionary breakthroughs "real soon now" One of these involves *antennafiers* that'll work just like a plain old crystal set. Others mimic photosynthesis, using nothing but the main ingredient in house paint and a few molecules of a very special dye.

For ongoing solar developments, check *Science* and *Nature* magazines, in that technology section (usually on page B4) of the *Wall Street Journal*, and, of course, the *Dialog Information Service*. More on what has happened so far by searching on *solar* keyword in my *GEnie* PSRT library.

An Opto Interface

One of the neatest opto chips to come down the pike in a long while is that TSL234 from *Texas Instruments*. This one makes an ideal first project in optoelectronics.

The $5 chip is a light-to-frequency converter. You simply power this 8-pin minidip with +3 to +5 volts, pick two jumper options, and shine some light on it. The output frequency is determined by the light intensity. If you aren't into computers, you could even use a headphone, a speaker, or an audio amplifier as an output.

The jumpers give you a 0, 1, 10, 100 sensitivity range and an output 1, 2, 10, 100 frequency scaling. Sorta like f-stops and shutter times.

Many more details in HACK80.PS on my *GEnie* PSRT RoundTable.

For audio tones, use a 100 scaling and a 1 or a 10 sensitivity range. You could even build up a Theremin-like musical instrument out of one or two of these besties.

Ultraviolet Flame Detectors

There's lots of obvious stuff to be hacked with ultraviolet. An EPROM eraser ferinstance. Or any plain old poster light. You'll also find great new uv cured adhesives and resins.

One source for lamps and such is *Ultra Violet Products*. A source for tiny fluorescent lamps (in uv, white, or colors) is *JKL Industries*. There's all sorts of opportunities here.

For one of the more oddball uses of ultraviolet light, look into the R2628 *uvtron* flame sensor from *Hamamatsu*. This low cost part is basically a neon lamp whose threshold is sensitive to ultraviolet radiation.

Since open flames have a spectrum well into the uv, this gem can detect a struck match at thirty feet.

All you do is set up a plain old relaxation oscillator. Output pulses dramatically increase in frequency in the presence of a flame. While the intended role is for gas appliance safety aps, there should be all sorts of great hacker uses.

More in HACK28.PS on *GEnie* PSRT.

Finally, you might want to check into the *Fluorescent Mineral Society*. If you are interested in geological uses for ultraviolet light.

This Month's Contest

Let's have two contests this month. I want to do a *Resource Bin* on the most popular hacking devices of all time. I've got a bunch of my own to suggest. But I'd like to know your favorites as well. Or else send me info on an optoelectronic resource that I don't know about.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (602) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

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You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM.

Don Lancaster's

RESOURCE BIN

number thirty-four

Some new developments in remote controls.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (602) 428-4073 weekdays 8-5 Mountain Standard Time.

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I did manage to wrangle a super special signup deal for you *Resource Bin* readers. Ten free hours and zero first month minimums. See the trailer blurb for details.

Remote Controls

There sure has been a lot of helpline interest lately in remote controls. So, this month I thought I'd try a remote roundup. Especially since there's two brand new players here having lots of hacker possibilities – modifying heart rate monitors and the superb *E-series* by *DesignTech International*.

The object of any remote control, of course, is to send commands or id signals over a distance. There is no "best" way for all possible uses.

Important considerations are the range, the reliability, your cost, the media, the power, the transmitter or receiver size, licensing and legality restrictions, the ruggedness, ease of use, the data rate, duplex potential, compliance to any standards, packet collisions, and potential interference both between units and any outside conflicting sources.

There's lots to select from.

Let's look at some of our options here. To sort this all out, we'll work our way up more or less in order of increasing frequency…

Heart Rate Monitors

Let's start off with a real sleeper of a hacker opportunity. One that is *still* going begging.

I like to define *short haul telemetry* as any scheme which is usable to send information over a very limited range. Say five feet or so. The obvious uses include exercise gear, *isopods* for safe monitoring of power line currents and home energy consumption, counting cows, for robotics, providing security id, or getting info on or off a rotating shaft. Or other moving object.

There's an aerobic exercise beastie called a *chest style heart monitor*. You wear a strap on your chest. The strap uses body contacts to sense the EKG electrical heart signals. It transmits to a nearby display, usually worn on your wrist or mounted on a bicycle. For its intended purpose, this system is vastly more convenient and more reliable than those nearly useless ir *plethsymograph* devices.

Mostly because there's no *motion artifacts* and because you can see your results at a single glance.

But what you really have here is a low cost and easily hacked universal short haul telemetry system. It works by inductive coupling. As an air core transformer between transmitter and nearby receiver.

NEXT MONTH: Don looks at the most popular hardware hacking parts of all time.

Each heartbeat gets sensed as a microvolt signal and converted into a 36 cycle burst of 5 kHz energy. These bursts are easily received with any old multi-turn iron core coil. Except for a deep axis null, the response is largely omnidirectional.

Total manufacturing parts cost in quantity is $5 or so. For a micropower, sealed, and reasonably waterproof system. The internal lithium coin cell usually lasts a year or more.

For hacker use, you would convert whatever it is you want to sense into a low frequency series of pulses. Max rate is in the 50 to 100 PPS range. The bursts themselves could get used for simpler remote controls, while their repetition rate could be used to send out analog data.

WARNING: Do not open, disassemble, or modify a heart monitor in any manner if it's ever again to be used for any human or animal purpose!

One popular heart monitor brand is *Polar*. Many variants are stocked by *Creative Health Products*. Replacement chest units list for $24 or so.

There's several other resources for short haul telemetry in general. *Dallas Semiconductor* has lots of fine stuff in this area. The topic is also covered in such obscure trade journals as *Access Control*, the *Identification Journal*, in *ID Systems*, or *Automatic ID News*.

More info on pulse monitors in HACK68.PS. And more on *isopod* short haul telemetry in HACK47.PS.

Audio Tones

Plain old audio tones can get used for remote control. The usual ploy is to generate a tone either electronically or with a whistle. Detection is often by a bandpass filter followed by a 567 phase lock loop tone decoder.

You'll find whistle type remotes in those DYS (*distressed yuppie surplus*) catalogs. The wholesale sources can be found in *ASD/AMD Trade News* and in the really great but pricey offshore publications from *Asian Sources*.

Besides sounding obnoxious, most whistle systems are unreliable.

So, instead of designing your own audio remotes from scratch, it makes far more sense to use existing systems and standards. Touch tone is a good

route. Major sources of phone chips include *Teltone, Silicon Systems*, and *Sierra Semiconductor*.

Pager tones could also be a useful choice. One popular system is called HSC, short for *hexadecimal sequential code*. Those MX503 transmitter and MX013 receiver chips from *MX-COM* are typical examples.

Even cuter than pager tones is the CTCSS. Short for *continuous tone, sub audio squelch*. These form a group of standard *subaudio* frequencies from 67 to 250 Hertz. These are usually *below* normal voice comm frequencies and thus (with care) cannot be heard. The MX265A is a typical encoder/decoder chip, again from *MX-COM*.

A special low pass filtering gets included to prevent speech or other audio interference.

The intended use for CTCSS is to send private messages over a common radio channel. Presumably, only the intended receiver gets activated when the tone is present. All of the other receivers remain mute.

But the extension to slide show or multimedia controllers is obvious. So is any other use where you want to send "silent" control signals over any live audio channel.

Because of those very low carrier frequencies, the acceptable signalling rate is very low. Ten commands per second or less. The channel usually has to be voice grade only, since bass music tones would interfere with the remote control signals. But you could compromise and use only the lowest tones and a lower audio cutoff.

Much more on using CTCSS in HACK71.PS on *GEnie* PSRT.

Carrier Comm and BSR

The power lines run all over your house. Why not try to use them for signalling and intercoms and remote control? This scheme is called *carrier communications*. One of the first real jobs I ever held was designing carrier comm for mine safety.

Traditionally, a frequency in the 50-200 kiloHertz range got itself FM modulated with the voice or control signals, coupled to the power lines or train tracks or trolley overhead, and then received and decoded where it's needed. But these days, you may find *severe* problems in trying to use the power lines for carrier comm.

First, because many light dimmers can generate an incredible amount of power line interference. Second, most computers and their peripherals have powerful line noise filters that can literally short out the carrier comm frequencies. And third because there are new and severe restrictions (both FCC and European) on the allowable power levels.

Your most popular carrier current scheme is the BSR system. A series of transmitter and receiver modules that are intended for home automation uses. The classic insider secrets story on these appeared in the September 1980 *Radio Electronics*. Besides *BSR* themselves, *Heath*, and *Radio Shack*, *Circuit Cellar* sells lots of construction projects and computer interfaces.

The main negatives about the *BSR* system? It is one way only, leaving you with no verification over whether the action actually took place. Which can cause major safety problems in industrial controls. Most houses split up their 220 volts incoming into two separate 410 volt distribution phases. Any BSR coupling between phases is usually poor to totally lacking.

The max data rate is extremely slow. There is zero collision avoidance for multiple senders. System noise immunity is poor. As we've already seen, any single frequency power line carrier current comm is easily trashed by dimmers and noise filters. And neighboring houses can interfere.

Nonetheless, the BSR system is a cheap and computer friendly route to home automation.

An obvious carrier comm solution is waiting in the wings. And this is to go to *spread spectrum* systems where the *entire* frequency range from mid audio up to the am broadcast band is used. Thus dramatically improving the noise immunity and ability to deal with line filters.

By using different spreading codes, multiple transmitters can work with their intended receivers. And do so totally interference free. Full duplex two-way comm is also a snap.

One very high profile approach to spread spectrum remote control is the *LonWorks* from *Motorola*. But after I had read all of their expensive promo materials, I am left with a feeling of "Did they do this on purpose?" To me, their grossly overblown LonWorks fiasco appears to be a textbook perfect example of a megacorporation run amuck. And an outright con. Any kid in a garage could easily come up with a cheaper and simpler system.

Sorry, but there is way too much baggage here. Whatever happened to elegant simplicity? Any $2 PIC chip

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makes a lot more sense to me.

Both *SGS* and *Signetics-Philips* now offer new spread spectrum power line control chips. More on these after I check them out.

Ultrasonics

Once long ago, ultrasonic remote controls in the 40 kHz range were quite common. But their popularity clearly has peaked. In general, nearly anything you can do with ultrasonics can get done simpler, cheaper, and more reliably with infrared.

But you can find these at zero cost on junker tv sets, and they are still used as a BSR option. They also see use as "tapeless" tape measures.

The ultrasonic transducers remain available surplus, often priced from $2 to $5. Do note that higher voltages, custom step-up transformers, plus very careful matching are needed.

Note also that ultrasonic signals literally blow away outdoors in the wind. And that vehicle engine fans can generate an incredible amount of interfering ultrasonic energy.

Most of the infrared receiver and controller chips can also be used for ultrasonics; more on this shortly.

Ham Radio

Many radio amateurs have a lot of interest in remote controls. Especially for the *autopatch* routines needed by repeaters. Much of this has now been published in the ham magazines and in tightly targeted newsletters such as *Repeater Journal*. Lots of kits and low cost systems are available.

See my *Resource Bin* reprints or else NUTS17.PS for more info.

Citizens Band

Most of those radio controlled toys and models use license free Citizen's Band radio frequencies in the 27 MHz range. Often with a power limit of 100 milliwatts or less. *Radio Shack* has a low cost remote control kit. And mags such as *R/C Modeler* are crammed full of ads for ready-to-go units.

Citizen's Band remotes have major interference problems. But they can do a lot of tasks cheaply and simply over useful ranges. Pulse modulation *servo* techniques can be used to send analog control signals.

A good source for remote control chips is *Samsung*. Especially in their *Linear Data Book*. Full transmitter and receiver schematics are included. The KA2303 (3 channel decoder), KA2309 (7 channel decoder), and KA2310 (7 channel encoder) devices are typical modern examples.

These circuits are often combined with superregenerative receivers. But do note that any homebrew superreg *must* provide a preceding rf amplifier stage. Otherwise, it might generate *severe* interference and trash out the intended band of operation.

FM Broadcast Band

There's a lot of misinformation out there over FM broadcaster systems for voice and remote control uses. Most of those widely advertised low cost devices are (A) highly illegal; (B) have nowhere near their claimed distance; and (C) most *will not work at all* with synthesized FM *receivers!*

The problem is that a properly done FM transmitter *must* be very stable *and* be frequency pullable with the audio or control information. Units that drift around can *not* be properly received on a digitally synthesized radio. Even a rock stable unit often will *not* get received if it is not closely locked to a standard FM channel.

Let's start with professional gear. Commercial FM *wireless microphones* are readily available, both in and out of the FM band. You'll find lots of ads for these in *TV Technology*, in *Radio World*, and similar trade journals. The units can also be rented.

The standard hacker chip here is the really great *Rohm* BA-1404, which combines its FM stereo multiplexer with a rf transmitter. The bottom line is that their stereo part works like a champ *if* a 38 kHz crystal is used for the stereo pilot. But their transmitter portion is *totally useless.*

A good compromise solution is to modify any CD to car radio adaptor. These combine a BA1404 with an ultra stable crystal controlled rf oscillator. Through very careful circuit design, their oscillator is both rock solid *and* can get linearly modulated over the full stereo spectrum.

Typical units here are the *Pioneer* CD-FM-1 or the *Sony* XA-7A. Costs are in the $30 range. The Pioneer unit is larger and more easily hacked. The Sony model offers two channels. For increased range, a small booster stage could be added, possibly using one of the many wideband amp chips from *Mini-Circuit Labs.*

More on these topics in HACK24.PS and HACK52.PS on *GEnie* PSRT.

The Best Remote of All...

Very few people realize there's an obscure paragraph or two buried in part 15 of the FCC regs that allows licence free remote controls with *ten times* the usual power. Mark Gottleib of *DesignTech International* has come up with several superb new hacker remote controls operating in the UHF range at 330 MHz. They are intended mainly for on-off control commands and similar low data rate uses.

The transmitters are the size of a keychain tag. In fact, that's what they are. They have got one, two, or three buttons on them, sending a selected code from the 16,777,216 possible. A monitor LED lights red, yellow, or green for the chosen channel.

#20051-E is a one-code transmitter at $44.95. The #20061-E is a three-code transmitter at $49.95. These differ only in the number of buttons.

#30021-E is a compact four code, single channel receiver. Any of four transmitter codes causes an output relay to close for half a second.

Power can be done "hacker mode" from an external 12 volt wall adaptor. Or the "garage mode" power can be robbed from a conventional garage door control loop. Multiple channel receivers are also available.

A five inch antenna is needed. If possible, your receiver should get placed high and line of sight. Hold the transmitter horizontally.

The effective range easily exceeds 300 feet line of sight. The signals also can pass through car windshields or walls of ordinary construction.

Which makes this great new system ideal for many "long driveway" apps. Or for remote gates. Or countless farm or industry applications. I've now got these in use here at my *Synergetics* as a remote "get the phone" signal.

A #30020-E transmitter receiver pair is also offered at $79.95. Contact them directly for info on their other unique remote control products.

More circuit details and plenty of application info on these appears in HACK82.PS on *GEnie* PSRT.

Wireless Solutions

There's now a brand new 900 MHz *wireless* band. Nearly everybody is scrambling all over each other to offer powerful new spread spectrum mice, modems, and similar two way remote controls. License free.

So 900 Mhz is definitely where the future action will come down. Today, though, the products are still klutzy and expensive. Many still share their gold-plated military background. This near-microwave frequency range is hard to hack because of the exotic test gear and specialized knowledge.

Not to mention the black magic. But it is getting ridiculously easier than it once was. Is it ever.

If you do not know what a Smith Chart is, you can forget about most wireless work. If you do know what one is, you'll find lots of them in SMITHCHT.PS on *GEnie* PSRT.

The best new trade journal here is *Wireless Design & Development*. Such older mags as *Microwave Journal*, *RF Design*, and *Microwaves & RF* have lots to offer as well.

One source for surplus transmitters and receivers is *Fair Radio Sales*. But watch the legality here.

Infrared and Optics

Most television and VCR remotes now send ir light. By pulse width modulating a low cost light emitting diode. These work fairly well, and have pretty much replaced the older ultrasonic remotes. So long as only one ir unit is active at once.

The ir light is fairly good at bumper shot bouncing off walls, but it can not get through a closed door. Longer range repeater units are available that can relay the commands down halls. As are intelligent remotes that can be "taught" the codes for any number of VCR's, TV's, or CD's.

One leading chip source here is *Plessey*. Who has encoders, decoders, and receivers. Start with their *Cable, TV, and Audio Databook*. Older parts here include the SL486 receiver and the SL490 transmitter.

An *Infrared Remote Control IC's* data pack from *NEC* is also very useful. It has good info on their programmable uPD6125 device.

By the way, replacement remote controls and control chips are stocked by *ECG*, by *NTE*, and by various other advertisers in *Electronic Servicing.*

This Month's Contest

For our contest this month, just tell me about any unusual remote control problem or solution you might have. There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

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Don Lancaster's

RESOURCE BIN

number thirty-five

The best hardware parts of all time.

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I did manage to wrangle a super special signup deal for you *Resource Bin* readers. Ten free hours and zero first month minimums. Plus major new Internet access features. See the trailer blurb for details.

What are the best hacker parts of all time? This month, I figgured we'd round up some all-time greats.

While several of my choices are clearly from older and simpler days, they still remain fine starting points for understanding electronics. And show us some of the heritage of how we got to wherever it is we seem to be going. We'll start off with...

The All-time Grand Champion

This one's a no-brainer. By far the overwhelmingly most popular hacker part of all time.

Unchallenged and unchallengable.

Let's see. This nine cent part is an organ tone generator, a proportional power trigger, strobe device, holiday "twinkle" light, and a dc coupler.

It is an ac/dc discriminator, a hot chassis safety checker, power monitor, surge arrestor, ignition timing device, phono speed setter, square wave gen, polarity sensor, frequency divider, or transmit/receive switch.

Besides forming a shunt regulator, anti-static signal conditioner, bipolar clamp, sawtooth source, counting flip flop, a vacuum tube filament tester, a level voltmeter, or a touch sensor.

All the while serving as a lightning protector, synchronizer, psychedelic lighting system, pulser, bistable latch, leakage sensor, relaxation oscillator, and micropower radiation detector.

Of course, my meager app list does not barely begin to scratch the surface. We could easily take up the rest of the magazine and then some.

Sadly, the all time grand champion seems pretty much retired these days. Done in by its limited output and the shift to low supply voltages. And the fact that everything else got better and cheaper along the way.

The 1N4005

Yeah, it is really mundane. Only costs around three cents surplus. But at one time, building power supplies and converting ac to dc was a real big deal. Hot and heavy, even.

The 1N4005 is a silicon power diode rated at one amp and 500 volts. It is the "standard" way of converting ac line power into raw dc. Gets done by letting current travel in one direction only. About the size of half a single base pin on the 5U4G vacuum tube it replaced. And ridiculously cheaper, cooler, and more efficient.

NEXT MONTH: Don looks at recent happenings in Book-on-demand publishing.

What was really cute was this story that appeared just after silicon power diodes first showed up. Your "other" solid state alternative was big stacks of selenium rectifiers.

At that time, the CEO of the leading selenium rectifier outfit essentially said "Yeah, silicon rectifiers may some day have limited advantages. But for those applications where smaller size, high efficiency, great ruggedness, fine reliability, and ultra low cost are not significant design factors, selenium rectifiers will still dominate."

I guess he was right. Sort of.

In the same league as the 1N4005, would be a general purpose low level silicon signal diode. Such as the early 1N914 or its 1N4148 replacement.

And, fer sure, that good old 1N34A germanium "crystal set" diode.

Also a one chip regulator. Perhaps a 7805. In the old days, regulators were complex and costly. Usually, you flat out couldn't afford regulation. And had to take what you got in the way of input supply variations.

Power Triacs

I guess any old power triac will do. Say the 276-1000 from *Radio Shack*. A triac is basically a high current, high voltage power switch. Apply a small pulse or a control signal to its *gate* input, and the triac flips on, sending heavy current between its main two terminals. The triac *stays* on until such time as the main current either drops to zero or reverses.

Important uses for triacs are solid state power relays, lamp dimmers, or motor controls. In a power relay, a continuous signal is applied.

In a lamp dimmer, a brief pulse is applied whose *phase* can be adjusted with respect to the ac half cycle. Only selected portions of power cycles get to the lamp load, and the lamp only partially lights.

A motor control is similar to a lamp dimmer, except that feedback of some sort gets used to give constant speeds and more torque.

Triacs could also be used for *color organs* or more modern psychedelic lighting controls. Soldering stations are a triac variation on dimmers and motor controls that use temp sensing. A simpler one-way variant on a triac

is a SCR. These get used for electronic ignition and tv deflection.

While easy and fun to use, there's one big warning: *Extreme shock hazards exist in nearly all triac circuits!* So, be careful. That same "hot chassis" shock hazard can get coupled back into the rest of your circuit.

Isolation ploys include a MOC3010 optotriac isolator from *Motorola*, any coupling transformer, or sealing the *entire* circuit in a plastic case.

Also, simpler triac circuits can *not* be used to dim a fluorescent lamp or control the speed of an ac induction motor. But newer and fancier ones definitely can. Triacs also generate a lot of interference, and special input filters are often needed.

The legendary and all time greatest databook here is the long gone *SCR Manual* from *General Electric*. Current triac info appears in the power data books from either *Motorola* or *Texas Instruments*. Two specialty companies include *LSI/CSI* for drivers and *Teccor* for the triacs themselves. Major trade journals include *PCIM*, *Motion*, and *Measurement & Control* magazines.

The 741 Op-Amp

At one time, precise direct current amplifiers were a real bear to design. Most every amplifier was for ac only, because of horrendous offsets, drifts, and device variations. I remember a long ago gas chromatography project where my best efforts at a gain-of-40 dc amp failed miserably.

Well, shortly after that, somebody came up with the new concept of an *operational amplifier*. First, build a ridiculously high gain dc amplifier. Thousands then, millions today. Then place *passive* network feedback parts around the amp.

Given enough gain, the amplifier's performance was determined *only* by the values and ratios of those passive resistors and capacitors. High gain and low offset dc amplification finally became trivial.

For instance, a 10K input resistor and a 100K feedback resistor on an op amp gave you a gain of ten. An input resistor and a feedback capacitor gave you an *integrator*, or low pass filter. Any input capacitor and a feedback resistor gave you a *differentiator*, or high pass filter. And fancier networks gave you fancier responses.

While initially intended for analog computers, both hackers and circuit designers quickly picked up on the fact that these made all sorts of great general purpose lab circuits.

The earliest important integrated op-amps were the 702 and the 709. Bob Widlar territory. The less we say about these, the better. But the first cheap, stable, and easy-to-use amp was the 741. Which exists to this day in a zillion different variants.

Much more on op-amps in my *Active Filter Cookbook* or in Jung's *IC Op Amp Cookbook*. There's lots of ap notes as well. Sources include *Maxim*, *National*, *TI*, *Motorola*, *Analog Devices*, *Linear Technology*, and *Burr Brown*.

The 555 Timer

I never did like this one. The 555 was a fussy power hog first cobbed up in a klutzy *InterDesign* do-it-yourself ic kit. But the rest of you clearly loved it. And apparently still do.

The 555 is basically a digital power latch or flip flop. Driven by a pair of set and reset threshold detectors. All in the plastic 8-pin minidip package. With duals, quads, and long output counters also available.

Usually, you would add a resistor and capacitor feedback network. As the capacitor charged and discharged, your 555 would create a free running square wave generator, or an *astable multivibrator*. With timing intervals from tens of microseconds up to days. You could also use the R/C feedback for reset only, for making pulses or a *monostable multivibrator*.

The 555's main claim to fame was a unique design scheme. By placing the threshold levels at precisely one time constant (roughly 63 percent) towards supply or ground, many voltage and temperature effects tended to cancel out. More or less. A *ratiometric* design which lead to unusual accuracy for a simple analog device.

For more on the 555, see Walter Jung's *IC Timer Cookbook* or most any issue of *Electronic Design* or *EDN*.

Several tips if you must use this beast: Select those greatly improved CMOS versions. Carefully bypass the supply *at your chip* with both a 10 microfarad and an 0.01 microfarad capacitor. *Never* float that reset pin, especially with a long wire or trace on it. If unused, bypass your reset *up* to the *positive* supply.

For serious waveform generation, you are much better off doing stuff digitally instead. Or, if you must go analog, check into that ancient 8038 sine-square-triangle generator from *Harris* or else the latest new MAX038 reincarnation from *Maxim*.

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CMOS Analog Switches

Most electronic devices do have a clearly defined input and output. And usually generate offsets and output delays. But any old turned-on CMOS transistor appears like an ordinary resistor. Place a NMOS and a PMOS transistor in inverse parallel, and you form a *transmission gate*.

Which, in its off state, looks like a very big resistor. And in its on state, looks like a fairly small resistor. A resistor that doesn't care that much which end is the input or output. Or whether it is analog or digital.

CMOS analog switches formed a new class of electronic components. One with no vacuum tube equivalent. The quad 4066 is typical. They cost a quarter or so each.

Important uses are for audio and video switching, for general purpose digital logic, or anywhere else you'll want to pass or block a signal. While avoiding offsets or delays.

Two of my favorite analog switch tricks: An analog switch and some op-amp hooked up just right form an amplifier with a switchable gain of plus or minus one. Which builds a single ended mixer or sync demod.

Having one digital and one analog input. Transformer free.

Place any analog switch in series with a resistor. Next, duty cycle the switch at a high frequency. You now have a digitally variable resistor! At least at lower frequencies.

Ferinstance, a 10 K resistor and a 1:3 duty cycle looks like a 40 K resistor. Because the resistor is only "there" a quarter of the time.

You can also hang analog switches across real keyboard contacts, letting you easily link two wildly different electronic systems.

Much more on analog switches in my *CMOS Cookbook*. Besides the grunt CMOS parts, fancier devices are now offered by *Maxim*, *Linear Technology*, *Dallas*, and *Analog Devices*.

AMP Piezo Film

A *free* hacker's component certainly needs to be included in our list. This one gets attached to the data sheet when you ask for info. And is easily converted into a hi-fi microphone, a fire sensor, a touch control, people detector, or an impact monitor.

Take a *Kynar* plastic film and heat it above its *Curie Point* while applying a stong bias voltage. Then cool the film, locking in the *stress* from the field and creating an *electret*.

Once it is formed, bending the film generates a voltage. Or applying any voltage bends the film. The same film is also *pyroelectric* and heat sensitive. Even to a moving human body.

Compared to any traditional piezo crystals or ceramics, the films are a lot thinner, cheaper, and lighter. But also somewhat less sensitive.

Piezo film has a long and strange corporate history. This started out as *Pennwalt*, who became *Atochem*, who got bought by *AMP Piezo*.

At any rate, *AMP* has samples, ap notes, data sheets, and development kits available on request.

RTL Digital Logic

Early digital integrated circuits had a "ten dollar horse and forty dollar saddle" problem. The military insisted on hermetically sealed, rugged, and wide temp packages. Which kept all prices outrageously high.

Fairchild was the first to break the cost barrier by simply glopping the chips in a low cost epoxy. Offered as *RTL Resistor-Transistor-Logic*.

The µL914 was an eighty cent dual two input gate. Cross couple it and you built a flip flop or storage latch. Since linear integrated circuits were also insanely overpriced, you could take one of these and bias it into a "long tail pair" style of differential amplifier. Which made a cheap and dandy linear integrated amplifier. I even built up a treasure finder out of these which appeared on the cover of the January 1967 *Popular Electronics*.

Also in their series was the µL923 counting flip flop. Which shortly got replaced by the dual MC790P J-K flip flop from *Motorola*. This device made low cost digital instruments possible. See the February 1968 issue of *Popular Electronics* for details on low cost RTL decimal counting units.

Admittedly, RTL did have power, noise, and speed problems. But it did lead the way and showed what was possible. Newer replacements are the *TTL* and *CMOS* logic families.

More details in the *RTL Cookbook*, *TTL Cookbook*, and the *CMOS Cookbook*. And in those *Resource Bin* reprints. In hard copy or on *GEnie* PSRT.

The 6502

I even named my license plate over this one. Sigh.

Back in the bad days where klutzy microprocessors had theoretical list prices near $1000 and you could not even get on the list unless you paid cash up front for a zillion of them delivered someday maybe, an upstart third-tier semi house by the name of *MOS Technology* got this idea.

They took some obvious and sorely needed improvements that *Motorola* management was too dumb and too arrogant to see, and created a beastie called the 6502, and offered them by big handfulls at Wescon. Literally in bushel baskets, at $22 a pop.

The rest, they say, is history. The 6502 was a hardware hacker's dream device. A full fledged 8-bit micro that had simple klick-klunk timing, very powerful addressing modes, and one single power supply.

Hackers quickly picked up on the chip, with *Ohio Scientific* being one early adoptor.

MOS Technology themselves came out with a $140 KIM-1 computer full of bright new innovations. Such as a real keypad instead of 0-1 toggle switches. A genuine numeric display instead of flashing lamps. And off-line cassette storage with auto search.

Yes, chess games, adventures, and even word processors were written for the bare bones machine having a whopping 1K of RAM memory. Some KIM-1's ended up speaking CPM and using pairs of eight inch drives. My own KIM sported full video and an EPROM burner. I fondly remember the combo 4K memory and hotplate.

KIM clones by the names of SYM and AIM quickly followed. Who, just as quickly, threw out the baby and drank the washwater.

By not having the slightest clue.

One of the Wescon attendees was apparently a guy by the name of Steve Wozniak. Whose Apple I and Apple II jump started the industry.

Their 6502 also got used in early Atari and Commodore machines. Plus countless video games. Home and arcade. Especially early Nintendos.

The PC world would certainly be a better place today if Motorola and Intel had simply cloned the 6502 and then improved upon it. But instead, megacorporation political games and conflicting superhuman egos created today's horrendous mess.

6502 stuff does remain available through *Rockwell, Western Design* and *Mitsubishi*. Until recently, 6502 chips remained the most popular choice for import VCR's and blenders.

But the momentum is clearly lost.

I wrote a great heaping bunch of Apple and 6502 books, but most of them are long out of print. I'll reprint them on CD-ROM someday. A scant few copies of my *Micro Cookbook I* do remain available.

By the way, next time you are near some ic chip designers, ask them to define a "RISC" device. After they are done arguing and get on down to an essential bare bones definition, just say "Oh, you mean a 6502."

And watch the fur fly.

PIC Chips

Scott Edwards and I were in *Karen's* the other day. Which is the very finest restaurant in all Elgin, Arizona. And quite possibly the best in the entire universe. At least in our galaxy.

While Scott instantly agreed with my number one choice, his choices for two through six were PIC, PIC, PIC, PIC, and PIC. I did caution Scott that the PIC chip has yet to prove it has "legs". But it's certainly a fine choice.

And clearly the heir apparent to the 6502 and its offspring.

Microchip Technology makes the PIC parts. Smaller dedicated micros that completely blow away anything that *Motorola* or *Intel* has ever offered. Just about any hacker mag today will have at least one PIC project in it.

What makes this PIC so special? First and foremost, PIC's are easy to use and fun to work with.

Also, the PIC uses a non-traditional, or *non-Von* architecture. Older 8-bit micros combined all their instructions and data into one space. Which made sense when memory was expensive and every trick in the book (including self-modifying code) had to be used to get your program to fit.

Instead, the PIC puts its commands in one place and its data elsewhere in a separate stash. The data is the usual 8-bits. But the instruction words are typically 12, 14, or even 16 bits wide. Which lets a *single byte instruction* do tasks that needed two, three, or even more traditional bytes. Resulting in double or triple speeds.

Several incredibly powerful macro instructions are included in their PIC set. A/D converters, serial data comm, timers, option pickers, sound gens, and duty cycle modulators.

To the point where it is usually far easier to start with a PIC chip instead of going with bits and pieces.

Costs start at $2.50. Development is trivial, and can be done on most any host PC. Once entered, the program is non-volatile and semi-permanent.

Let's see. To get started, pick up the *Embedded Control Handbook* and the *PIC Data Book*. Then use that simple and friendly *BASIC Stamp* by *Parallax*. Or see back issues of *Nuts & Volts* for "pseudostamp" alternatives. Finally, step on up to the fast and furious *PIC Design Tools* from *Scott Edwards*.

Well maybe one hint. Go to Elgin and take the loop thruway past the primary industrial district. Then hang left at the fifth cow. The one you'll see munching the grapevines.

For extra points, do try and locate Elgin without using a large scale map.

This Month's Contest

Let's have a real easy contest this month that gives you older readers a distinct edge. Just tell me the correct part number for that all time grand champion hacker part. Be sure to get the punctuation right. Or else tell me about any other popular hacker part you feel belongs in our survey.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

I've just picked up a great heaping bunch of Apple II+ and IIe computers, cheap enough to apply as dedicated controllers. And even including a few rare and collectible Apple III's as well. Lots of cards, drives, monitors, and parts, too. Call for info.

Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (602) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For modem access: (800) 638-8369. When prompted, enter JOINGENIE. When asked for a keyword, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM.

Don Lancaster's

RESOURCE BIN

number thirty-six

A Book-on-demand publishing update.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (602) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle a super special signup deal for you *Resource Bin* readers. Ten free hours and new Internet access features. See the trailer blurb for details.

Why Book-on-demand?

I recently saw some figures where traditional 1993 book sales were only up by a mere 0.3%. The 7% increase in revenues was caused by an 8% raise in the list prices.

Clearly, old line publishing has its onager in a sling.

Insane "musical chairs" mergers and acquistions have thrown the baby out with the washwater. Greed, fear, and incompetence reign supreme. The chains have demolished the Mom and Pop stores, while stocking many more copies of far fewer books.

The publishing delays have gone up rather than down. Nothing readable remains on most book racks. Most back lists have been decimated. Partly because of obscure IRS "Thor" rulings that literally pay publishers to shred books. Much like farmers are paid not to grow crops.

There's also hot new competition for reading time. Online resources, video games, CD ROM, VCR rentals, virtual reality, computers, magazines, trade journals, cable, and satellites.

But there's also explosive demand for new info. When it gets presented quickly, cheaply and on a custom basis. But "electronic only" publishing remains a commercial failure and will continue to be so for quite some time. Because nothing electronic remotely comes near the "feel" of a book.

The one great hurdle that electronic publishing has yet to jump.

There's also the tiny problem that people *buy* books but *steal* software. Information in electronic form tends to be grossly undervalued compared to the same written word.

Which is where my *Book-on-demand* publishing comes in. Today, you can produce first quality books at home on your kitchen table. And do so at low costs in small quantities. At way less risk, and with ridiculously faster turnover times. With literally *zero* makeready and no prepress. Instantly updatable.

Exactly like "real" books from "real" publishers. Except for the loving care that went into yours.

With ridiculously higher author's royalties, *instantly* paid.

Book-on-demand publishing really shines where 2000 or fewer copies are needed. Or where the total sales are still unknown. Or where the topic is too specialized or too controversial to interest an old line publisher.

NEXT MONTH: Don looks at unique sources for sensor and transducer products.

Or where content needs customized or personalized for each reader. Or can be combined into a larger package with disks, kits, or whatever.

BOD Insider Secrets

Here, briefly, is what you'll need for Book-on-demand publishing...

(0) - Use toner, not ink. Toner based printers are ridiculously cheaper, and have more consistent quality. They need zero makeready or prepress.

(1) - Use Genuine Adobe PostScript. Level II or higher. Nothing else even comes remotely close. *TrueType*, *TeX*, and *PCL* are outright jokes.

(2) - Use two-way comm. Proper use of PostScript *demands* on-screen error messages and host recordable comm. Anything else blindfolds you and ties both of your feet together.

(3) - Use 600+ DPI resolution. With photo enhancements. And be sure to optimize your artwork for the printer you are now using.

(4) - Use a bolt-on duplexer. These give you double sided printing with fewer hassles and less scrap.

(5) - Use a printer hard disk. Hard disks allow unattended operation and dramatically speed up printing time. They also free the operator and host computer for other tasks.

(6) - Learn PostScript. The more you use and understand "raw" PostScript, the easier problems will be to resolve, and the better your print quality.

(7) - Refill all your own cartridges. Cartridge refilling reduces per-page toner costs from 3 cents a page to 0.2 cents per page. This is your secret key to making BOD cost competitive.

(8) - Have service manuals on hand. Get the needed service manuals and do your own repair work. If you can change the blade on a power mower, you can do most laser repairs.

(9) - Distill your files. Properly done PostScript code runs at full printer speed, with *zero* setup time. Details on my *GEnie* PSRT.

(10) - Consider Adobe Acrobat. The Adobe *Acrobat* system offers a simple

way to distill PostScript and view it on screen. It also now has free readers and ultra easy indexing.

Which Printer?

The answer to this one changes weekly. An ideal BOD printer would offer genuine Adobe PostScript level II beyond 600 DPI and use enhanced photo halftones. It would cost under $2000, print faster than 10 pages per minute, and have *both* a duplexer *and* a hard disk available.

It could print totally unattended. Service manuals and parts would be easily gotten. The toner refills would be cheap and simple.

A "straight through" paper path and a tabloid (11 x 17) option would also be rather nice.

We're getting real close. The *Apple LaserWriter* 16/600 has everything but a duplexer. The *Hewlett-Packard* 4M+ has everything but a hard disk. Their 4MV is tabloid sized for covers and lacks only a duplexer. That 4MV hard disk is a historic first for HP.

Lexmark has several compellingly interesting new machines that I have yet to test. These do *not* use *Canon* engines and have unproven recharge economics. But some models do offer duplexing and hard drives.

I do not care for those toy 4 PPM laser printers. They remind me of $999 hot tubs. Which look good in the ads and on the showroom floor. But you'd never want to sit in one or put any water in it. Cheapest is *never* the best bang for the buck.

Several other manufacturers never have and never will be able to get it right. Others lack genuine PostScript or use obnoxious sales people.

Bargains do exist in older machines. But stick with *Apple*, *HP*, or possibly *QMS*. From *Shreve Systems*, *PreOwned Electronics*, or the many advertisers in *Computer Hot Line*.

Note that most printers arrive with uselessly little memory. Especially for duplexing and page downloads.

Fill the machine immediately.

The ongoing developments in laser printers usually show up in *Electronic Publishing*. Outstanding laser printer training and parts are offered by *Don Thompson*. Toner refills ads appear in *Recharger* magazine.

If I had to pick one today, I'd say go with the 4M+ and hope for a hard disk feature "real soon now". Or, if you can get one cheap enough, spring for the rugged but older 4SIMX.

Paper

Many different types of paper can be run through a typical laser printer. The *laser rated* papers and films are obviously your best choice. No-no's include *tyvek*, unsupported acetate, or very heavy stock. Older coated papers may not work at all.

Control of humidity is *extremely* important for serious BOD work. Stay in the 30 to 45 percent range for best results. Super cheap $4 hygrometers are sold by *Klockit*, while the serious instruments come from *Abbeon-Cal*. A duplexer dramatically reduces paper curling problems.

Paper weight is an oxymoron dreamt up by paper salesmen to confound outsiders. It has nothing whatsoever to do with how heavy a ream of the paper weighs, how thick it is, or how opaque it is. Ferinstance, 24 pound paper is *lighter* than 70 pound paper. But *heavier* than 60 pound paper.

Instead, *always* use the *metric weight* . Shown in grams per square meter. If you want more info, pick up the free paper standards book offered by the *S.D. Warren* folks.

For plain old paper, the $16 per case sheets from *Price Club* or wherever can't be beat.

One fine source for low cost quality papers is *Paper Plus*. They've got 100 or so locations in 30 states.

There's now dozens of direct mail laser paper sources coming out of the woodwork. They do tend to be pricey, but they offer fast delivery and lots of exciting stocks. The earliest was *Paper Direct*. Imitators include *Paper Access*, *On Paper*, *Queblo*, and *Premier*.

Many offer sample kits.

Very interesting laser rated colored and coated *LaserCast* stocks are sold by *Darcy*. They take toner well.

I use LaserCast on my *Synergetics* catalog covers. For BOD volumes, I use 60 or 70 pound (grrr… make that 89 and 103 gsm.) *Simpson Offset*. Some fake parchment covers are currently *Hopper Skytone*. For my camera ready work, I use *Nekoosa Laser 1000*. Some "94 bright" super whites are newly announced, but they are still hard to get in small quantities.

Cover Durability

Toner is not rugged enough to be used on a book cover. If you must use toner on covers, use as little of it as possible. And stick to bold or ultra bold typography. Even then, protect it somehow.

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Two simple ways to improve toner durability are *Bakerizing* and *Laser Buddy*. To Bakerize, you place the toner in contact with a mylar sheet and apply heat and pressure. This calendering and remelting makes the toner a glossy and dense black and improves its durability. Laser Buddy is a simple spray that is almost as good. The spray briefly dissolves the toner, making it blacker, sharper, and more "camera ready". $8 per can.

The obvious use of artist's fixative instead is a no-no. It can badly bleed toner images.

LaserColor is your next step up in durability and appearance. These are hot stamp foils. You'll place them in contact with your toner artwork and apply heat and pressure. The toner acts as a foil-grabbing glue.

A cheaper variant is the *FoilMax* series from *Jerry Michel*. This one uses continuously fed hot stamp rolls.

Unfortunately, their application machine is ludicrously overpriced. But easily faked from an old *Canon* fuser assembly.

If you want to experiment on your own, bulk foil sources include *Maple Roll Leaf*, *Hoechst*, *Lamart*, and *Transfer Print Foils*. Transfer Print's free *Foiled Again* newsletter is a "gotta have".

A pair of the more useful trade journals here include *Converting* and *Paper, Film, & Foil Converter*.

Lamination is your ultimate toner protection. While you could use the peel-and-stick stuff from Wally World or wherever, this looks awful.

Those real lamination systems are surprisingly cheap from *USI*. Matte is preferable to gloss for most uses.

Even better are those new *lay flat* laminating films. These breath air and moisture. And usually are more than worth their premium price.

A second, but more costly, source of laminating stuff is *GBC*.

The ultimate would be the aqueous film UV cured "varnish" the big boys use on book covers. While cheap, I know of no simple way to apply this uniformly in small quantities. But others have reported some luck using windshield wiper blades.

Binding

Many binding systems are totally useless for BOD aps. Besides being obscenely overpriced atrocities. One of the very worst, of course, is plastic comb binding. Which is a gross and demeaning insult to your customers.

You could get the same effect by stapling a used baby diaper to your front cover.

But wire binding may be useful, especially for any lay-flat instruction manuals or material that is going to be opened often. One leading source here is *Wire-O*. *Specialized Bindry* has a freebie video on their options.

For "semi-professional" needs, such as a fire department annual report or

a modest proposal, that non-perfect *Personal Velobind* can be useful. Cost is in the quarter range, with the punch often discounted to $29 or so. You punch up to 25 or so pages and then snap them together with plastic. One tip: Use *four* hands while punching.

Misalignment trashes pages.

I personally like the *Unibind* perfect binding system. Which is a series of covers having hot glue preapplied to them. You drop them in the toaster, heat them for half a minute, whomp them on a steel plate to form them, and let them cool. Around a dollar per book. Their $200 list toaster is free if you buy enough covers.

I have used the clear plastic covers, overlaying toner printed on some fake parchment cover stock.

But the best solution for BOD I've found to date is the second Unibind product known as *Pentabind*. This is simply a folded pair of flysheets with preapplied glue. You print *any* cover material *any* way you like and wrap the cover around the pentabind. You then drop your pages inside, toast it and whump it.

Spine lettering is trivially added beforehand.

Although obscenely expensive and impossibly difficult to communicate with, the *Planax* folks do have several interesting products. One is a cold glue binding scheme that sets up in half a minute. The secret is pressure dewatering. In general, the cold glue systems are better than hot. Planax also has *Otabind* variations.

The ultimate BOD binding product would be plain old low cost hot glue peel-and-stick perforated sheets. You would rip these off, stick them inside your custom cover, drop the pages in, and cook it like any other Unibind product. Planax has these, but only at totally outlandish prices.

Marketing

A crucial BOD problem is that it does not address marketing. Having a stack of books in your living room may be nice. For a while. But it sure is nicer to see them profitably flying out the door to pleased readers.

I've addressed alternate and small scale book selling and distribution problems in my BOOKMARK.PS and REV1001.PS on *GEnie* PSRT. These are also available as a small part of my *Book-on-demand Resource Kit*.

Do note that it is *absolutely essential* to have an ISBN number and a bar code for your titles. Otherwise, *no* library or bookstore will touch it. As BOOKMARK.PS tells us, you get your ISBN numbers from *R. R. Bowker*. Cost is only two dollars or so each, but you do have to buy many dozens of them at once. Bowker also publishes *Books in Print*, a publication that it is also *essential* that you get into.

One national book distributor who is not overly hostile to smaller presses is *Baker & Taylor*. The alternate small press distributors often advertise in the insanely great *FactSheet Five*.

Beyond BOD

Self-publishing is useful to several thousand copies or so. Or when the total market is unknown.

An alternative to making the actual books yourself is to use some *Service Bureau*. These are just someone else's BOD setup which has some excess capacity. My favorite here is David Seid's *Access Laser Press* in Phoenix. He goes direct from PostScript disk to Docutech. But note that your costs will be much higher since the service bureau also has to cover expenses and make a profit off your title.

Traditional book printing has big time front end charges. Because of the prepress hassles, 3000 books will cost you about the same as 500. That's for the same *total* bill. The bottom line is that *it is outrageously expensive to print less than 2000 books at once by old-line methods.*

Traditional publishers which accept the smaller press runs are *OmniPress*, *Bookcrafters*, *Thompson-Shore* (get their free newsletter), *Gilliland*, or *Crane*.

Always get samples first.

One key rule: Do not *ever* go to a local printer to print your book. They will rob you blind. Instead, *always* go *directly* to the same national short run book specialty firm your local printer will be farming the job out to.

Printshop Resources

In general, old line printers are a clannish and an archaic lot who are extremely hard to communicate with. Traditional printshop products are *all* overpriced. Unless you take an expert along, you are *certain* to get burned on *any* used printshop gear.

As with any field, your greatest equalizers are the insider catalogs and trade magazines. Start with *Printer's Shopper*. Despite its misleading name, this is a useful distributor's catalog. Who stocks all of the bits and pieces needed to run a printshop. The prices aren't all that great, but they do have at least one of everything.

My favorite classified shopper mag is that West Coast *HorseTrader*. With *California Printer* a lookalike second.

Fine bargains in both.

Another regional mag is *Southern Graphics*. A national coverage pub is *Printer's Hot Line*.

Lots of printshop software exists. One source is *Printer's Shareware*.

The best "small shop" trade journal is *Quick Printing*. Especially for the great *Helene's Hotline* product locator service and data base.

Also check *Instant Printer*, *In-Plant Printer*, and *InPlant Reproductions*.

Useful products for BOD appear in *Graphic Arts Product News*, and, of course, that wondrously bizarre *U&lc* typography magazine.

Free and sometimes useful old-line also-ran's do include *Print Equipment News*, *Printing Journal*, *Printing News*, *Publishing Technology*, *Screen Printing*, *Print*, and *High Volume Printing*.

For More Info

Additional info on all this appears in my *Book-on-demand Publishing Kit*, along with samples, catalogs, reprints, and bunches more. The *GEnie* PSRT PostScript RoundTable is very strong in this area, with well over a thousand files now available on line. Start with my STARTUP.PDF and SPEEDUP.PDF. Then search the library for "BOD" or "demand" keywords.

We have also got the GhostScript sharewave that could let you explore PostScript on-screen viewing. Free Acrobat readers, too. Custom Help is also available on most anything BOD. Per the no-charge voice helpline and email links below. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (602) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For modem access: (800) 638-8369. When prompted, enter JOINGENIE. When asked for a keyword, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM.

Don Lancaster's

RESOURCE BIN

number thirty-seven

A look at sensors and sensing.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (602) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle one super special signup deal for you *Resource Bin* readers. Ten free hours and new Internet access features. See the trailer blurb for details.

Sensors and Sensing

This month, I thought we'd take a look at sensors and sensing. A *sensor* is any device that converts some other physical attribute into an electrical or electronic signal. Sensors of one sort or another are involved in just about any electronic project.

And they sure are one hot topic on our helpline and on PSRT.

Usually, there will be two stages involved in any sensor problem. First, you'll have to do your actual sensing. This gets done using a *transducer* of some type. The result is often a very small signal, possibly a few tens of millivolts. Noise is *always* a problem in any sensing situation. And *extreme* caution is required to take care of this very weak signal.

Next, you will typically have to do some *signal conditioning* to convert the sensed signal into something useful. Such as a higher current, a pulse train, or a digital word.

Signal conditioning tricks include shielding, differential mode sensing, isolation, offsetting, amplifying, temp comp, filtering, and A/D conversion. For really small signals, synchronous detection, correlation, integration, or averaging can also be applied.

Four sources of conditioning chips are *Analog Devices*, *Crystal*, *Signetics*, and *Linear Technology*.

Unusual newer sensor technologies and ideas often appear in courses and publications from *SPIE*.

Sensor Trade Journals

As I may have mentioned a time or two before, those free trade journals are *the* best way to get informed in a big hurry on almost any subject. Start with *Ulrich's Periodicals Dictionary* on your library's reference shelf.

This gem lists some 150,000 trade journals and other magazines.

At any rate, your horse's mouth trade journal is *Sensors*. From Carl Helmers of early *Byte* magazine fame.

Also try *Measurement & Control*.

You can also go to industry specific mags for all sorts of useful stuff. Say *Pollution Equipment News* for typical environmental sensors, *Powder & Bulk Solids* for level controls, or *American Laboratory* for chemical sensors. Or even *Weight Engineering* for coverage on strain gauges.

NEXT MONTH: Don looks at high frequency techniques and hackable resources.

One Stop Shopping

Your highest profile source for just about any sensor is *Omega*. These folks offer scads of impressive free catalogs on temperature, level, flow, pH, strain, pressure, data acquisition, and bunches more. Pricey, though.

One shirtsleeves source for nearly any industrial sensing instrument or tool is *Abbeon Cal*.

Temperature

The traditional way of accurately measuring temperatures is to use a *thermocouple*. This is simply a pair of connected but *dissimilar* metals. The millivolt-size output voltage ends up related to absolute temperature.

You do have to provide a *cold side compensator*, which usually will offset to ambient room temperature or zero degrees. And you have to be careful not to allow other dissimilar contacts anywhere in your sensing loop.

Thermocouples are identified by letter. In order of increasing temp, as types T, J, E, and K. Type J is made of iron and constantan.

The free *Temperature Handbook* from *Omega* is the thermocouple bible.

Thermocouples are often best for the high temperature measurement of kilns or whatever. But the usual rule is to avoid them when you can.

Your standard hacker temperature sensor is the ordinary silicon diode. These change by *minus* two millivolts per degree C. Usable to 150 C.

The 272-0123 from *Radio Shack* is a low cost digital thermometer using a diode sensor. Other low cost sources advertise in, of all places, *Food Service Product News*.

Which is also a great diet mag. Just read it before each meal.

And then guess whether that blue glop in the big bottle is a new dessert topping or a grease trap clarifier.

The semiconductor folks have long ago discovered that any pair of silicon diode junctions operating at different currents gives a linear output that is proportional to absolute temperature. The earliest example of this was the *National* LM224. Also carded at *Radio Shack*. Output current changes by one percent for every 3 degrees C.

A handfull of really exciting new chips have recently been announced. *Dallas* has a DS1620 combined digital thermometer and thermostat. *Analog*

Devices sells a TMP01 programmable controller. Range of both devices is -55 to +125 C. One obvious use is as a hot tub controller.

Pressure

Silicon pressure sensors are rapidly becoming low cost commodities.

These are basically a "drumhead" etched into bulk silicon. Strain sensors are implanted on the drumhead. As the pressure changes, the drumhead flexes, causing a resistance change.

There are two main pressure sensor types. The *absolute* sensor compares pressure against a perfect vacuum. A *differential* sensor instead compares a pressure difference that's *between* two ports. If one of those ports is left open to your ambient air, then you have a variant called a *gauge* sensor.

Temperature compensation and a lot of amplification are often needed when sensing pressure. Some sensors are offered both as raw chips or with signal conditioning and temperature compensation built in.

Your two most obvious sources for the pressure sensors are *Motorola* and *Microswitch*. But the real action comes down from *Sensym, I.C. Sensors,* and *Novasensor*.

Sensym has a *Solid State Pressure Sensors* handbook. This one includes a great slide chart.

An oddball use for pressure sensors is in low pressure tire alarm systems. *Fleet Specialties* is one source.

There's also some purely resistive approaches to pressure sensing. One source is *Interlink Electronics.* With mice and music apps.

For ultra cheap, you can sometimes get by using nothing but the black anti-static foam that chips arrive in. But repeatability and reliability can be big problems here.

At the high end, *Force Imaging* sells subminiature and quite thin sensors that work from 1 to 20,000 PSI.

A modification to a pressure sensor will let it measure acceleration. The motion of a mass is sensed. The rate of change of motion of the mass is the mass velocity. The rate of change of the velocity is the acceleration. Except for airbag sensors, these devices are still very expensive.

One source is *Silicon Designs.*

People Detectors

A person emits a very distinctive spectrum in the far infrared. The old way of dealing with this was with a *pyrolitic detector*. Any and all sanely priced people detectors have a unique problem. They are basically capacitors and only respond to *changes.*

One older workaround was to chop up your signal using a fan blade or a vibrating reed. A better and newer method is to use a special *Fresnel* lens that has "hot" and "cold" optical areas. As the person crosses the beam, the signal strength changes.

A newer and cheaper approach to people sensing is the *kynar piezo film* from *AMP Piezo*. This is just a plastic sheet that is sensitive to both flexure and infrared inputs. Free samples are literally stapled to their data sheets. Besides people detectors, this product builds shock sensors, heat detectors, and really great microphones.

Because the Fresnel lens design is tricky, you are better off starting with a commercial $12 occupancy detector and kitbashing it. A California law mandates these in all new building construction, so they are a commodity part. Electrical supply wholesalers are your usual source. *Leviton* is a major manufacturer.

Light

There are a wide variety of light sensors out there. The *photoconductive* sensors made from cadmium sulfide vary their resistance over a wide (but highly nonlinear) range with temp.

Again carded at *Radio Shack.*

Ancient *photomultiplier tubes* still remain the sensor of choice for ultra sensitive astronomy and similar uses. *Hamamatsu* is the leader here.

Solar cells will generate a current proportional to input irradiance. For self powered calculators, or remote site power generation. Lots of these in *Home Power* magazine.

Three variations on solar cells are *phototransistors, photodarlingtons,* and *phototriacs.* These amplify to produce a much stronger signal. But they do need external supply power. These get used for everything from dusk to dawn sensors, door openers, power isolation, and shaft encoders.

Lots of ads for these right here in *Nuts & Volts. Burr-Brown* is one source for low cost, large area detectors with built-in conditioning. The MOC3020 is a typical *Motorola* phototriac.

But *Texas Instruments* has just run away with all the marbles. They have an exciting new line of low cost and hassle-free *light-to-frequency converters.* Their first device is the programmable TSL230. They've also got a TSL235 in a lower cost vertical package. Under a

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(800) 323-4340

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(408) 432-1800

Institute of Navigation
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Alexandria VA 22314
(703) 683-7101

Interlink Electronics
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(805) 684-2100

Iotron
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Synergetics
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New Prov NJ 07974
(908) 771-7714

Walker Scientific
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Worcester MA 01606
(800) 962-4638

Weight Engineering
PO Box 1043
Alton IL 62002
(618) 377-9096

buck and a half in quantity.

For starters, pick up their *TSL230 Applications Brief*. More use details in NUTS33.PS and HACK80.PS posted to my *GEnie* PSRT.

pH

A *pH sensor* measures the acidity or alkalinity of a chemical solution. The most likely use you'd have for one is for swimming pool maintenance. Or maybe for water quality checks. The sensor probes are a chemical cell the shape of a small test tube.

Ion conductivity through a porous membrane generates a voltage that is proportional to pH.

These *demand* dc amplifiers having a super high input impedance. Temp comp and tracking is a must.

Calibration is also important. Many older systems do this by using stock *buffer solutions* for adjustment.

A circuit and more details on a pH meter in my *CMOS Cookbook*.

Sources for pH probes are *Omega, Fisher, Corning, Markson, Cole-Parmer, Iotron,* and *pHoenix Electrode.*

Current theoretical info shows up in *Analytical Chemistry*.

There's a brand new pH measuring scheme called the *field sensitive FET*. I'm still trying to chase this one down.

Please let me know if you can find me any more details on these. A free *Incredible Secret Money Machine II* for your trouble.

It's a Gas

Gas sensors can be used for alcohol breath analyzers, in carbon monoxide alarms, and fuel vapor detectors.

These are magic compounds heated by a platinum wire. The resistance is a function of the concentration of your target gas. These are usually *not* very selective, so other activating gases can cause problems.

Your leading source here is *Figaro.* More details and working circuits in my *Hardware Hacker* reprints.

Magnetic Fields

The stock solutions to sensing fairly strong magnetic fields are devices using the *Hall Effect*. Which is just a current related to field strength.

Two main sources here are *Allegro/ Sprague,* who offer a great *Hall Effect Optoelectronic Sensors* data book. And *MicroSwitch* who has their older but highly useful *Hall Effect Transducers* applications manual.

Linear Hall Effect parts output a voltage which is proportional to the magnetic field. Digital parts output a logic level or pulse train.

Nearly all Hall devices are woefully insensitive. They only work properly with *strong* magnetic fields such as a *nearby* magnet. One that is *very* close. One quarter inch is really pushing it. Still, these are the low cost device of choice for position and speed sensors. Also for use with proximity sensors and flowmeters.

Two main sources of premium Hall magnetic sensors and instruments are *F.W. Bell* and *Walker Scientific*.

But note that Hall devices are *totally* unsuitable for compass sensing of the earth's magnetic field. They miss by two to three *orders* of magnitude.

One compromise solution builds a

compass with a rotating magnet and then decides that magnet's position. Low cost *Dinsmore Instruments* parts do just this. But their accuracy is often limited to 22.5 degrees or so.

Mechanical motion is involved.

Instead, *the* device to use for high quality compasses is the *fluxgate*. This is simply a small magnetic core. One winding switches the core into and out of saturation. When *not* saturated, the core "gathers in" nearby lines of the earth's field.

When saturated, the core "releases" the lines. A pair of X and Y windings senses this gathering and releasing, producing output pulses that end up proportional to the local strength of the earth's field.

One source of hacker fluxgates is *Magnetic Research*. A quality source of fluxgate compasses is *KVH*. Others do advertise in *GPS World*.

The *Institute of Navigation* is another extremely useful resource here. As is the *Navtech Bookstore*.

A fluxgate alternative is offered by *Precision Navigation*.

A construction project on fluxgates appeared in the January, 1994 issue of *R.F. Design* on pages 24-32. And full construction info on a unique low cost fluxgate compass project appears in my *Hardware Hacker III* reprints.

Humidity

The *humidity* is the amount of water vapor in the air. Which might be the *absolute* quantity of water present. Or else the *relative* amount of moisture compared against your max possible without fog or rain. Humidity is a very strong function of temperature, so you nearly always have to measure the temperature as well.

Zero cost humidity sensors include horsehair, an unwashed blond human hair, or a nylon fishline. They all get longer and shorter in response to the humidity. Surplus fishline humidity controllers are available from several *Nuts & Volts* advertisers.

The most accurate way to measure humidity is with a *chilled mirror*. A mirror on a thermoelectric cooler gets adjusted to the *dew point*, the temp where condensation first occurs. Light either does or does not get scattered to servo the temperature to the dew point. A simple (but highly nonlinear) calculation finds the humidity.

A variation on dewpoint is the *sling psychrometer* or those related *wet bulb* and *dry bulb* systems.

Sadly, there is no really cheap and universal solid state humidity sensor. Those that do work operate only over a limited humidity range. And they tend to be outrageously expensive in small quantities.

Several of the better sensors are capacitors whose dielectric constant changes with humidity. These can be micropower and directly generate a frequency in a simple RC oscillator. Sources include *General Eastern* and *Panametrics*. Related moisture sensors are offered by *HyCal*.

Since surface adsorption is often involved, most humidity sensors are easily contaminated. Certain sensors can get flushed or otherwise cleaned; but others can not.

There's also older resistive sensors. But not used much, though.

One very low cost source of analog hygrometers is *Klockit*. *Abbeon Cal* sells better grade instruments.

This Month's Contest

As our contest for this month, just tell me about any unusual or little known sensor resource. Or tell me about some new off-the-wall sensor use or application.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

I have just picked up some more Apple II+ and IIe computers, cheap enough to put to use as dedicated controllers. And even including a few rare and collectible Apple III's as well. Lots of cards, drives, monitors, and parts, too. Call for info.

Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (602) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For modem access: (800) 638-8369. When prompted, enter JOINGENIE. When asked for a keyword, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM.

Don Lancaster's

RESOURCE BIN

number thirty-eight

Exploring high frequency resources.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle one super special signup deal for you *Resource Bin* readers. Ten free hours and new Internet access features. See the trailer blurb for details.

High Frequency Resources

At one time "high frequency" meant amateur radio. Possibly with a little citizen's band stuff thrown in. These days, though, you're more likely to be interested in TVRO dishes, wireless mice and modems, speed and sports radars, cable tv or weather satellites, ATV television, cellular phones, video rebroadcasters, GPS navigation, SETI, radio astronomy, scanners, wireless microphones, LAN networks, remote controls, or spread spectrum.

As you raise the frequency of any electronic circuit, your needed tools and techniques will change. Circuit strays first become really critical and then impossible. At high freq, you'll go to *distributed* and *transmission line* design techniques. Lumped coils and caps get replaced by cavities, helical resonators, or striplines.

Special transistors and ic's may be required. In tiny packages.

Your signals often get too small and too fast to view directly. Noise gets crucial. These days, analog flat out won't hack it anymore. Practically all new high frequency designs are going totally digital. Or nearly so.

At some point "black magic" sets in. System design becomes more of an art than a science. And you either do or do not have a "feel" for that art.

Firstoff, we'll leave the *status quo* right where it is. Your best beginning point still remains the...

Radio Amateur's Handbook

Newly reissued in its *seventy second* reincarnation, this must have gem is now known as the *ARRL Handbook for Radio Amateurs*. Here you'll find lots of hands-on and readable coverage for high frequency basics.

Fair Radio Sales

My long time favorite source for surplus high frequency stuff is *Fair Radio Sales*. Still at the same old stall after all these years. Their free flyers list genuine bargains in older military surplus. Which can be a great place to get started. They've also got older test gear. Cheap but heavy.

Another possibility is *Radio Research Instruments*. These folks are way more expensive than Fair Radio. They also have the snide habit of not publishing prices with their catalogs. But this is where you'd go for an entire military surplus radar system or a working 50 foot microwave dish mount.

NEXT MONTH: Don looks at the many perils and pitfalls of automotive electronics.

Mini-Circuits Labs

Most microwave stuff tends to be outrageously overpriced. Owing to its gold plated military heritage. But one major exception is *Mini-Circuits Labs*. Who offer broadband and low noise dollar "MAR" amplifiers.

One competitor is *California Eastern Laboratories*. Hot new hf products are those miniature ceramic resonators and filters. *Trans-Tech* is one source.

Heathkit

No, they didn't drop *completely* off the map. They're just a much smaller and leaner company than they used to be. Heath's main focus these days is industrial education. They still have bunches of hf self-study courses.

Ham, Comm, and Cable Mags

We covered these in depth earlier, so I won't repeat myself here. Other than to note in passing that these are all highly useful resources.

Detailed ham radio pub reviews in NUTS17.PS on *GEnie* PSRT. For cable insider mags, NUTS29.PS. And for cellular, mobile, and general comm secret stuff, HACK64.PS. These are also available in my *Resource Bin* and *Hardware Hacker* reprints. As per my nearby *Synergetics* ad.

But I will mention three unique mags: *ATV Quarterly* and *ATV Today* on amateur television. And *Weather Sat Ink* for weather reception info.

Industry Trade Journals

My favorite mid-frequency pub is that free *RF Design*. Their December, 1994 issue describes a mind-boggling TRF receiver breakthrough. One that completely blows away superregens and single conversion superhets. Not to mention extending the useful range of *unlicensed* aps past 1000 feet.

By far your finest microwave trade journal is *Microwaves and RF*. Lots of solid technical articles. They also do a *Microwaves Product Extra* tabloid. And a second shopper is *MPD*, short for *Microwave Product Digest*.

The *Microwave Journal* is oldest of old line microwave publications. At one time, they also had outstanding technical articles.

I keep getting these strange phone calls from people pretending to be in their editorial department. Asking me that I do *not* send them any more subscribers or advertisers. Apparently we are beneath their dignity.

Or else their publisher is the victim of a cruel hoax.

There is also a *Defense Electronics* trade journal. Desperately searching for a mission.

An obscure resource that often has good high frequency stuff in it is the free *Hewlett Packard Journal*. For some strange reason, though, it does seem to target only H-P products.

Wireless Design & Development is an exciting new trade journal. Free.

Data Books and Such

The best way to build up your high frequency info library is to read the trade journals. Then use their bingo cards to pick up data books, ap notes, and freebie samples.

There's scads of this stuff out there. Let's look into several useful starting points: *RF Device Data* from *Motorola. Radio Communication System IC's* from *Sony*. *Satellite, Cable & TV IC Handbook* offered by *Plessey*. *RF and Microwave Transistors & Diodes* from *Siemens*. The *Mixed Signal IC*'s from *MX-Com*. The *RF Wireless Comm* from *Philips*.

Spread Spectrum Comm

The concept of *spread spectrum* first started as military anti-jamming. But these days, your commercial aps are revolutionizing all of high frequency comm. Instead of assigning specific high power carriers to stations, each one is given a unique and broadband noise-like code. One that intentionally smears over a lot of bandwidth.

Since each receiver only responds to one unique code, many stations can transmit interference free.

Some of these applications may use *direct synthesis* spread spectrum where the entire band is used at once. Others use *frequency hopping*.

Yet another major benefit of spread spectrum comm is that much of it is license free. Since the transmit energy is broadband, very little interfering peak energy is present.

Let's see. The definitive text on this is Marvin Simon's *Spread Spectrum Communications Handbook*. Published by *McGraw Hill*. A 1200 page tome which gives a thorough (but at times difficult) coverage.

For those really complex details of commercial applications, try instead *CDMA: Principles of Spread Spectrum Communication*, from Andrew Viterbi. Who developed most forms of reliable digital comm in use today.

Published by *Addison-Wesley*.

Switching to a lighter and a more readable resource, check into Randy Robert's *Spread Spectrum Scene*.

Spread spectrum comm has long gone beyond the construction project stage. One older GPS build-it-yourself project was sold by Dan Doberman's *DKD Instruments*. But full commercial chipsets are the only way to go.

Suitable sources include *Rockwell*, *Harris*, *Qualcomm*, and *Maxim*.

GPS

One of the most developed spread spectrum uses is the *GPS* navigation system. Short for *Global Positioning Satellites*. A family of 24 roving birds, some of which are now overhead.

They broadcast uniquely coded but quite low level signals at frequencies in the 1200 and 1600 MHz range. The signals are way too weak to pick up on an ordinary radio receiver, but a specialized GPS receiver easily picks them up by using a small antenna. At least in most outdoor locations which have a patch of visible sky.

When you process the signals from three or more satellites, your current latitude, longitude, and elevation can be found. Velocity, too.

How accurate? Well that depends. The military reserves their option of fouling up the works for no apparent reason. By way of their wonderful "selective availability" option. With selective availablity off, your typical accuracy is 100 feet or so. But more like 500 when activated.

Naturally, workarounds to selective availability got hacked long ago. By going to a *differential* system, you can easily pick up accuracy in the twenty foot range. And down to five feet at extra hassle. The differential system works by having one fixed and one movable station. By comparing where the fixed station says it is to where it really is, you correct errors.

Since the corrections are useful over many tens of miles, commercial FM stations are newly transmitting GPS corrections on a subcarrier.

By going to fancy systems and long term measurements, GPS accuracy to better than one inch is possible.

There's also a technically superior Russky system known as GLONASS. Often used for European coverage.

A real cute example of what all of

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them French veterinarians call a "four paw" sure came down recently. One expensive and high profile full color ad of a GPS receiver sitting on a topo map. Proudly proclaiming its extreme accuracies. While it displayed a *four hundred* mile error! Naturally, their photo studio was nowhere near the location on the topo map.

Do beware of ancient GPS receiver technology now being dumped to the distressed yuppy surplus houses. Our helpline lore reports the original *Sony* PIXIS is especially disappointing. The latest receivers are *much* better and actually lower cost than any of their deeply discounted ancestors. Insist on five simultaneous channels.

The leading trade journal here is *GPS World*. Who also occasionally do publish a *GPS World Product Showcase* tabloid shopper as well. One leading receiver manufacturer is *Trimble*, who offer several fine GPS tutorials. The best GPS technical papers come down from the *Institute of Navigation*. One good resource for related books and such is the *Navtech Bookstore*.

Smith Charts

Serious high frequency designers have to know and use Smith Charts. If you don't know what one is, you have no business trying to design anything above 100 MHz.

If you do know about these, we've got lots of roll-your-own Smith charts available as SMITHCHT.PS.

Really Far Out

One high frequency opportunity is still going begging. What I call the *mystery band* lies between 300 GHz and 10 THz. *Submillimeter wavelengths* or *quasi-optical frequencies*. This area covers 9.7 *TeraHertz*. That's enough for 1,600,000 HDTV signals. But it is almost totally unused.

Except posibly for the occasional radio astronomer or two.

This spectrum is unregulated!

Until recently, there's been no good amplifiers or oscillators for this band, but that's about to change.

The final open spectrum frontier is likely to turn into a stampede.

Your finest scientific journal here seems to be the *International Journal of Infrared and Submillimeter Waves*. Two related resources here are the *Society of Amateur Radio Astronomers* and the *Radio Observer* newsletter.

More info on hacking the mystery band appears in HACK84.PS.

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For our contest this month, just tell me about any unusual high frequency resource. Or any related opportunity.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For modem access: (800) 638-8369. When prompted, enter JOINGENIE. When asked for a keyword, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM

Don Lancaster's

RESOURCE BIN

number thirty-nine

Getting started in automotive electronics.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle one super special signup deal for you *Resource Bin* readers. Ten free hours and new Internet access features. See the trailer blurb for details.

Automotive Electronics

Those of you following my columns in *Electronics Now* already know about my automotive electronics saga. My 1987 *Synchro* 4WD van started bucking intermittently. Of course, I did not suspect for an instant that the 126,000 off road miles I put on it had anything to do with the problem.

After obvious tank-of-gas and fuel filter checks, I hauled it off 350 miles to my nearest factory authorized VW service dealer. Sigh.

The mechanic was unable to fix my auto computer. In fact, he could not even *find* it! In the search, he racked up a $1200.00 bill replacing perfectly good parts at random, totally trashed my Synchro's rear door, and generally ruined my weekend.

I then decided to treat this as an electronic problem rather than a car problem. I rigged up my oscilloscope to catch the intermittent on the run. And quickly found a bad solder joint in the ignition computer.

The bad soldering appears generic, caused by an unwettable steel lead on a power resistor. After a few years, a frustrating intermittent develops.

It turns out this is a very common VW problem. The grossly overpriced magic cable that is supposed to fix it proves that VW themselves did not have the faintest clue as to what the *real* problem is. Or the cure.

Uh, maybe one hint for the rest of you VW mechanics out there whose shoe size is larger than your IQ: That *Digifant II* engine computer is under the back seat. A back seat is the thing you sit on at the rear of the vehicle's passenger compartment.

And mashing *Vise Grip* pliers onto a brand new gas spring is a no-no.

This month, I thought we'd focus on how to pick up useful insider info involving automotive electronics. We will concentrate mostly on the engine control computers and such...

R. T. F. M.

Official factory shop manuals are readily available for just about every vehicle. With pricing typically in the $60 to $90 range. As I found out the hard way, it is *insane* not to *promptly* get the shop manual for your car.

Use it and read it!

NEXT MONTH: Don looks at emerging opportunities for home automation controls.

Among other things, your manual can instantly tell you how serious the problem is. And often gives logical, step-by-step instructions.

The shop manual lets you perform triage. You could thus decide if you want to screw things up by yourself, want to get done in by a local garage, or want to get totally and obscenely ripped off by the factory authorized repair service rep.

For instance, I found a driveshaft replacement to be doable by good old Dave's Texaco. (Uh, Dave did change brands years ago. But in a small town, these things take time. Distances here are still measured from the bowling alley that burned down 26 years ago. And is long since a condo.)

I found I could fix a jammed power window by myself. Once I figured out that a homebrew clamping jig is essential. It took much longer to build the jig than to make the actual repair. Details on request. But something like repacking the cv joints is best left to a dealer. Because the right formula of magic high tech grease is a must.

But the dealer will not end-for-end swap your CV joints unless you ask them to. Which can more than double their effective life.

SAE Library

Fundamentals of vehicle electronics (and most other subjects of vechicle engineering) are covered in depth by the *SAE Library*. Hundreds of books along with a few serials.

Once only the *Society of Automotive Engineers*, they've expanded to cover land, sea, and air.

A free catalog is offered. They do seem rather expensive. Although they occasionally have sales. Lots of useful electronic books here.

Robert Bosch

These folks are the foremost source of fuel injection systems and ignition computers. They pioneered the *lambda* feedback system.

Any chemical reaction needs exact ratios of input ingredients. Otherwise some of the inputs might be left over after the reaction finishes. A reaction is said to be *stoichiometric* when there is absolutely no excess left.

When you burn gasoline in any car engine, you have a choice of adjusting your *air to fuel ratio.* A ratio of 12.6:1 gives you the most power. A ratio of

16.4:1 gives you the best economy. A 14.7:1 yields minimum pollution.

Such a stoichiometric mix is said to have a *lambda* of 1.0.

Where does pollution come from? Simply from excess inputs that are left over. Too much gas, and you are *rich* and emit hydrocarbons. Too much air, and you are *lean*, and you have excess oxygen left. By itself, excess oxygen is not all that bad. Trouble is that those high temperatures convert the oxygen and nitrogen in your air into *nitrogen oxides* that produce smog.

A misnamed *oxygen sensor* between engine and muffler serves as your key feedback sensor in a lambda system. Its output voltage sharply increases in the *absence* of oxygen.

The purpose of a car computer is to sense the amount of input *air* (from your so-called "gas" pedal), and then adjust your fuel injection to give you an optimum mix.

One seeking a minimum pollution at $\lambda = 1$. A second role is to adjust the spark timing to give best power while avoiding any knocking. The optimum timing depends, among other things, on engine speed, load, altitude and temperature. A ROM-stored *map* picks the optimum timing for your present driving conditions.

Certain of those performance shops and specialty mags resell EPROM's containing different timing maps. But these EPROM's do not do nearly as much as you'd expect. Mostly because of that inherent feedback working around the $\lambda = 1$ operating point.

Two sources of custom map chips are *Dinan Engineering* and *Autothority*. Uh, we better mention in passing here that it is an EPA felony to *reduce* your vehicle's pollution or *improve* your gas mileage. If you tamper with *any* pollution control device while doing so. And an EEPROM map is certainly a pollution control device.

Your government at work.

More on all this in HACK84.PDF in my *GEnie* PSRT RoundTable.

At any rate, Bosch is the leader in fuel injection. They offer a number of free FI brochures including *Optimized Engine Management for a Brighter Auto Future* and *Lambda Sensor Exhaust Gas Techniques*. Good reads.

Robert Bosch also does publish the fine *Automotive Engineering Handbook*. A zillion definitive pages that come straight from the horse's whatever.

And fairly cheap at a nonmember price of $28. Aavailable directly from the *SAE Library* folks.

Robert Bently

Plenty of Roberts in the VW world. *Robert Bently* prints the best service manuals anywhere. Period. They are *the* place to go for VW shop manuals. Plus several other makes. Along with lots of other automotive titles.

I've found their *Bosch Fuel Injection and Engine Management* to be rather informative. By one Charles Probst. He authors a similar Ford book.

Their free catalog is a must.

By the way, the best VW parts place (especially for sanely priced *Synchro* parts) is the *VW Parts Place*. The most obvious generic mail order source for auto items is *J.C. Whitney*.

Other Publishers

The leading source of GM service manuals is *Helm*. Who offer hundreds of shop manuals on just about any GM product. Prices are typically $90 for the shop manual only. Or $120 for a kit of manuals and supplementary materials. Service notes, parts filche, and owner's manuals, too.

The *Coach Fix It* book #13900 from *Tomco* is supposed to have lots of info on car computer codes.

A nicely done booklet on Chrysler codes is *Your Car's Computer is Trying to Tell you Something*, by Roger Burch. And published by the *Hemispherical Publications* folks.

Electronic test equipment outfits do offer some useful resources. For Ford products, *Hickok* has a *TFI-IV Ignition Analyzer* and a *Ford Self-Test*. They sell stuff for other makes as well.

Tektronix has a freebie tutorial on *Servicing Automotive Electronic Sensors*. And *Fluke* has a free *Troubleshooting Electronic Engine Components*.

Two books recommended by callers are *How to Tune & Modify Ford Fuel Injection*. By Ben Watson.

Or maybe *Understanding Automotive Electronics*. By William Ribbens.

Other leading auto electronics book sources include *Motor Books, Haynes Publications, Standard Motor Products, Chilton, Reston*, and *Tab*.

And, of course, *Consumer Reports* has lots of more or less objective auto tests and reviews in it.

SunPro

The leading aftermarket source of car computer analyzers is *SunPro*. As sold by *Checker Auto* and similar retail auto specialty stores.

Typical products are their CP9001 GM code scanner, a CP9015 Ford code

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scanner, a CP9080 engine sensor and ignition module tester, or the CP7673 engine analyzer.

They offer a free *Unlocking Today's New Engine Technology* brochure. Plus their *Proven Precision and Performance* catalog on their products.

SunPro is a brand name. The actual manufacturer is *Actron III.*

Diacom

There are now bunches of vehicle analysis software being sold. But the highest profile supplier appears to be *Rinda Technologies* with their *Diacom Plus* products. These let a PC gather key performance data from your car's ignition computer.

Extensive online technical info gets placed inside most of their programs. Apparently you simply feed it your vehicle identification number, and it knows which version of which auto computer is in use. Earlier products were mostly GM and Chrysler.

While fairly expensive, they have received outstanding product reviews everywhere. Along with bunches of high customer praise.

Try *Go Rinda* on *CompuServe.*

Automotive Industries

There's a zillion car mags out there. As any check into a larger newsstand will attest. Insiders, outsiders, techie, folksy, glitzy, or whatever. As always, you can get a complete list of all these from *Ulrich's Periodical's Dictionary* at your local library. Or accessed online through *GEnie* or one of those other commercial online services.

My favorite freebie trade journal is *Automotive Industries.* Lots of insider things here. I particularly liked their listing of Internet resources on page 58 of their February, 1995 issue.

And I guess we gotta mention…

Henning's Motor News

No, they do not get into vehicular electronics too much, but if you need any info or any part for *any* older car–junker, classic, or antique, then this is your foremost resource.

Mostly an incredibly fat monthly magazine full of classified ads.

Many name brand dealerships are now refusing to even work on a ten year old car. Let alone stock parts for it. Which will make publications like Henning's even more useful.

Two other trade mags I subscribe to with occasional car stuff in them are *Machine Design* and *Design News.*

On-line Resources

Your best insider car computer info these days comes down in the online services. Especially on forums which talk about useful solutions.

GEnie has an *auto* RoundTable. Plus the *Auto-Quoter* and *AutoVantage* fee based services. These get you the best possible nationwide price on any new or used vehicle. Or tell you the *exact* dealer costs.

The real biggie is the Internet. Here you will find many hundreds of auto electronics related services. Such as *rec.autos.tech* and *rec.autos.marketplace*, *rec.autos.sport*, or *rec.autos.vw*

As we saw above, there's a fairly good list in the February 1995 issue of *Automotive Industries.*

I thought I'd share my experiences with one fine Internet service that is not on the above list. There's a VW vanagon and a VW bus site online at *lenti.med.umn.edu* This has about the best Synchro info anywhere.

Not much, but certainly the best. Westy freaks do seem to dominate the board. Campers all.

Traffic on a slow day is fifty or so messages. Posts on mech fixes, repair questions, classified ad sale listings, scheduling camping events, and such. Low cost hard copy service and repair info is also offered by several users. Including insider dealer stuff you are not supposed to ever see.

To subscribe to this superb service, you email *listserve@lenti.med.umi.edu* Then you enter a one line message of *subscribe vanagon* or *subscribe vanagon digest* The latter gives you one large file once per day. To cancel, you do an *unsubscribe vanagon*.

Editors sometimes do inadvertently add a hyphen in the middle of some online address. Especially an address that refuses to justify. This is a major no-no. Just remember that hyphens, spaces, or carriage returns are *never* used in any email address. If you see any of these, try leaving it out for your first access attempt.

There should *never* be a period on a sentence that has to end with an email address! Watch this detail.

The only little problem is that the vanagon info is overwhelming. Since I'm paid to be a *GEnie* sysop, I just don't have the time to wade through diffuse Internet excess blather to try and get at the useful stuff. Even if I

did, it would be unfair to my paying PSRT RoundTable users.

Those new "software agents" might solve this hassle. Tightly filtering to your exact needs.

An Internet site specifically for 1987 Synchro owners sure would be nice. But, there'd be one big problem here. Since 1987 Synchro owners with diff locks won't even speak to any lowly 1987 Synchro owners without the diff locks, you'd have flame wars.

This Month's Contest

Once again, I have a hollow feeling I have missed a few obvious biggies here. So, for our first contest, just tell me about any useful auto electronics resource that I don't already know about. Or just tell me a car electronics horror story. Funny or sad.

There's gotta be a lot of stuff out there that I missed. Do let me know all about them.

Or, for our second contest, just find me any clean late model low mileage Synchro. Preferably western, private, and diff locked.

Or recommend nearly *any* vehicle *anywhere* that could replace a Synchro. What I need is a $12,000 skid plated, posi, high clearance, granny geared, full time and all wheel drive 22 MPG vehicle which comfortably sleeps six people (or 23 cavers), one German Shepherd and a sheet of plywood.

Preferably one that also has decent solder joints in its computer.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all. ✦

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Don Lancaster's

RESOURCE BIN

number forty

New opportunities in home automation.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

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I did manage to wrangle one super special signup deal for you *Resource Bin* readers. Ten free hours.

GEnie now offers far lower daytime rates, a direct Internet access, and a Windows graphics interface, so it's an even better deal than ever.

See the trailer blurb for details.

Home Automation

There's a lot of interest these days in home automation. For increased comfort, reduced power bills, lower environmental impact, and improved security. While home automation has been around for twenty years now, this field is about to explode. Thanks to some rather interesting and brand new developments.

I guess I'd define home automation as any setup that lets computers and microcontrollers intelligently interact with a traditional home environment. In climate, cooking, lighting, security, and entertainment systems.

As I see it, there's three key issues today in home automation: (1) How is reliable and interference free *two-way* comm going to take place? (2) What standards (if any) should get used in the way of formats, protocols, and such? And (3) Where do we get a low cost, legal, and electrician-free remote current transducer?

Let's look at these issues in more depth. We'll pick up a few of the key players as we go along...

Power Line Comm

The "obvious" way to send control signals and status messages around a house is to use your ac power line. Simply because it is there and there are lots of outlets already present in every room. Most of what you need to control is already "on line".

The only problem is that power line comm does not work very well.

One of the first real jobs I ever had was designing carrier current comm devices for railroads and coal mines. In those days, you simply shoved 30 watts or so of FM modulated voice or control signals on back into the tracks. Useful frequency channels went from 30 kHz to 200 kHz.

Receivers were remarkably similar to what we could call a tv sound chip today. A limiter, discriminator, and an audio amp. Sensitivity was in the two millivolt range.

Sadly, the power lines have gotten real ugly since then. More and more things that plug into the power line generate badly interfering harmonics. Two of the worst offenders are power supplies and dimmers.

NEXT MONTH: Don looks at resources for security and alarm industry products.

Capacitor input dc power supplies often draw their current out as a short impulse current slug. Those dimmers have a sharp switching risetime in the middle of each ac half cycle. Both of these generate bad interference to any ultrasonic VLF carrier comm.

A second problem is that more and more things that plug into the power line now use superb noise filters.

A carrier system's information gets seen as noise by a filter. As an ancient example, that input filter on a *Diablo* 630 Daisywheel flat out blocks out *all* BSR control commands for a dozen or more feet in any direction. The typical computer lashup now has at least six filters that are as bad or worse.

These days, your home power line looks more or less like a dead short at carrier comm frequencies.

A third problem is that the signals may travel too far. Or not far enough. Controlling your neighbor's hot tub is obviously a big no-no.

Especially for its *piranha* mode.

Most home power systems consist of one center-tapped single phase 220 volt system that delivers two separate 110 volt *legs*. It is very hard for carrier signals to hop between legs. A large coupling capacitor might sometimes help. At other times a special linking circuit could get used.

Yet other times, a reliable coupling flat out ain't gonna happen.

Finally, the regulators have newly fouled things up. There are new and horrible restrictions on how much am radio interference gets allowed. These new restrictions can *severely* limit the amount of transmitted carrier power permitted. At the least, an expensive filter may be needed.

There is a brand new solution that's called *spread spectrum communications*. Using spread spectrum comm, pretty near the *entire* frequency range from 20 to 400 kHz is used by *every* channel. *Spreading codes* give outstanding noise immunity. And allows many sources to simultaneously communicate.

Interference free.

But spread spectrum carrier comm is so new that you have to work at the chip level or else go to costly systems. Two sources are *Signetics/Philips* and *SGS*. Another is the *Echelon* PLT-20.

One newsletter is Randy Robert's *Spread Spectrum Scene*.

The rule seems to be that anything less than full spread spectrum power line carrier comm appears doomed to failure. Thus, there is no point of even thinking about trying to do your own single channel FM or PWM lashup.

Power line carrier comm setups are routinely used by the electric utilities. More details on how the big boys do it by way of EPRI, that *Electric Power Research Institute*. They also publish a few home automation titles.

One chip source is *National*. They have teamed up with *Cyplex* and *Itron* to build new *IC/SS* products.

The most obvious source of power line comm products, of course, is...

BSR and X-10

The ancient home controller system that everybody loves to hate is made by BSR. And is called the X-10 system. With off-the-shelf modules offered by *Radio Shack, Heath*, and others.

Transmitters, lamp and appliance modules, computer interfaces, and the handheld remotes are offered. At $12 for a receiver module.

The appliance modules are for high current on-off control only. But lamp modules can be remotely dimmed or brightened. You must *never* connect an induction motor or any fluorescent light to their lamp modules.

The BSR transmitter has 512 codes grouped into a *home code* and a *unit code*. A code gets sent, followed by its complement, giving a limited amount of noise immunity.

Comm is one-way only. There is no way to verify whether your command actually took place. Unless you see or hear the result yourself.

The modules are cheap and sort of work. Some of the time.

Their major faults include one-way comm, slow speeds, few commands, no collision detection, the ease with which signals can get stomped on by noise filters, and the major difficulty of hopping phase legs.

Insider technical details on the BSR system are in a Steve Ciarcia story in the Sept. 1980 *Radio Electronics*.

Individual chips are also available. The basic control chips from BSR. And advanced computer interfacing chips from *MicroMint*.

Sources of BSR application products now include *Enerlogic, Jance Associates, Powerline Control, Creative Processing, Home Automation, JDS, Omnipotence, Remote Measurement*, and *Menange*.

Leviton is a second source for home controller modules. They also do get into occupancy detectors and similar stuff. Leviton has a *DEC Tech Manual*, the DEC Troubleshooting Guide, and a *Home Automation Network Guide*.

Infrared Comm

At one time, most tv remotes used ultrasonics in the 40 kHz range. But it turns out that nearly anything you could do with ultrasonics, you can do with near infrared. And usually do so far cheaper using much less power in a smaller package.

Thus, ultrasonics are no more.

A standard tv remote control uses a near ir light emitting diode to send out signals in much the same format as the ultrasonic originals.

Two good sources for details: The *Cable, TV, and Audio Handbook* from *Plessey*. Or the *IR Remote Control Data Pack* from *NEC*.

Two other sources for encoder and decoder chips are *Motorola* and *Holtek*. Holtek is stocked by *Digi-Key*.

But there's a brand new game in town that gives you ultra high speed infrared comm. This one is the IrDA standard from a group that calls itself the *Infrared Data Association*. The baud rates go from 115 Kilobaud to several Megabaud and higher.

There's a good IrDA review in the March 30, 1995 issue of *EDN*. One leading proponent is *Hewlett Packard*. Who now do offer free two-way *IrDA Evaluation Modules*. Another source is *Linear Technology* with their LT1319 ir receiver integrated circuit.

Infrared and power line comm are likely to remain your two biggies for home automation. Other candidates now include twisted pair phone lines, optical fibers, or the elegantly simple micropower comm used by aerobic pulse monitors. See HACK68.PDF for the astounding secret insider details on the latter.

There's also UHF wireless comm. Try *Wireless Design & Development* and similar trade journals for your latest and best in this area. I've uploaded an extensive listing of wireless resources to *GEnie* PSRT as NUTS38.PDF.

Which Standards?

Ideally, every home controller must be able to simultaneously talk to each other on an interference free basis. By using some sort of a unified and *fully open* public standard.

At the least, such a standard *must* offer full duplex two-way, multi host comm having a full collision detection and excellent noise immunity. It must

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Phoenix AZ 85023
(602) 843-2589

Black Range Films
Route 2, Box 119
Kingston NM 88042
(505) 895-5652

BSR
Route 303
Blauvelt NY 10913
(914) 358-6060

Circuit Cellar Ink
4 Park St #20
Vernon CT 06066
(203) 875-2751

Command Control
8800 Roswell Rd Ste 130
Atlanta GA 30350
(404) 992-8430

CompCo Enginering
611 Parkway Ste D4
Gatlinburg TN 37764
(615) 436-5189

Custom Command
115 Paint Branch Drive #3181
College Park MD 20742
(301) 314-7767

Cyberlynx Gateway
3066 Sixth Street
Boulder CO 80304
(303) 444-7733

Cyplex
472 Amherst Street
Nashua NH 03063
(603) 882-8104

Echelon
4015 Miranda Avenue
Palo Alto CA 94304
(800) 258-4566

Scott Edwards Electronics
964 Cactus Wren Lane
Sierra Vista AZ 85635
(602) 459-4802

Electronic House
56790 Magnetic Drive
Mishawaka IN 46545
(219) 256-2060

Electronic Industries Assn
2001 Pennsylvania Ave NW
Washington DC 20006
(202) 457-4900

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Nashua NH 03063
(603) 880-4066

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(415) 855-2000

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Englewood CO 80112
(800) 854-7179

Habitech95
5310 Harvest Hill Road #235
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(800) PARKS11

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Palo Alto CA 94303
(415) 857-1501

Holt Integrated Circuits
9351 Jronimo Road
Irvine CA 92718
(714) 859-8800

Home Automation
2709 Ridgelake Drive
Matairie LA 70002
(504) 833-7256

Home Automation Assn
808 17th Street #200
Washington DC 20006
(202) 223-9669

Home Automations Labs
5500 Highlands Pkwy #450
Smyrna GA 30082
(800) HOME-LAB

Home Automation Systems
151 Kalmus Dr Ste M6
Costa Mesa CA 92626
(714) 708-0610

Home Automator
2258 Sandy Lane
Mebane NC 27302
(910) 578-9519

Home Control Concepts
9520-108 Padgett Street
San Diego CA 92126
(800) CONTROL

Home Power
PO Box 520
Ashland OR 97520
(916) 475-3179

Home Systems
PO Box 6236
Oklahoma City OK 73123
(405) 840-4751

Home Systems Network
Box 3006
Edmond, OK 73083
(800) 808-0718

Honeywell
1985 Douglas Drive
Golden Valley MN 55422
(800) 345-6770

Infrared Data Assn
PO Box 3883
Walnut Creek CA 94598
(510) 943-6546

Information Store
500 Sansom St Ste 400
San Francisco CA 94111
(415) 433-5500

Intelligent Systems
175 New Britain Avenue
Plainville CT 06062
(203) 793-9951

Intellihome
8350 N Central Exp M1100
Dallas TX 75206
(214) 361-4044

Intellon
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(904) 237-7416

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JaMar Distributing
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Pasadena MD 21122
(410) 437-4181

JDS Technologies
16750 W Bernardo Drive
San Diego CA 92127
(619) 487-8787

Leviton
59-25 Little Neck Pkwy
Little Neck NY 11362
(800) 824-3005

Linear Technology
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Milpitas CA 95035
(408) 432-1900

Lone Wolf Corp
2030 First Avenue
Seattle WA 98121
(206) 728-9600

Makita
14930 Northam Street
LaMiranda CA 90638
(800) 4-MAKITA

Marvin
2020 Silver Bell Road
St Paul MN 55122
(800) 328-0268

Mastervoice
10523 Humbolt Street
Los Alamitos CA 90720
(213) 594-6581

Media Magic
PO Box 507
Nicassio CA 94946
(415) 662-2426

Menage Automation
120F W Campbell Avenue
Campbell CA 95008
(408) 378-9451

MicroMint
4 Park St Ste 20
Vernon CT 06066
(203) 875-2751

Microchip Technology
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Chandler AZ 85224
(602) 963-7373

Motorola
5005 E McDowell Rd
Phoenix AZ 85008
(800) 521-6274

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2900 Semiconductor Rd
Santa Clara CA 95052
(800) 272-9959

NEC Electronics
PO Box 7241
Mountain View CA 94039
(800) 632-3531

Omnipotence
2236 Cambridge Drive
Sarasota FL 34232
(813) 371-5085

Plessey
PO Box 660017
Scotts Valley CA 95067
(800) 927-2772

Powerline Control
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Northridge CA 91325
(818) 701-9831

Raindrip
21305 Itasca Street
Chatsworth CA 91313
(818) 718-8004

Remote Measurement
2633 Eastlake Avenue #200
Seattle WA 98102
(206) 328-2255

Security Etc
19 Alamo Square
Alamo CA 94507
(510) 838-9160

SM Automatic
10301 Jefferson Blvd
Culver City CA 90232
(310) 559-6405

Solartronics
76 Benbro Drive
Buffalo NY 14225
(716) 681-6686

Spread Spectrum Scene
PO Box 2199
El Granada CA 94018
(800) 524-9285

Synergetics
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Thatcher AZ 85552
(602) 428-4073

Unity Systems
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Redwood City CA 94063
(415) 369-3233

Kenneth Wacks
9 Pinewood Road
Stoneham MA 02180
(617) 662-6211

Wireless Design & Dev
301 Gibraltar Dr
Morris Plains NJ 07950
(201) 292-5100

Zomeworks
PO Box 25805
Albuquerque NM 87125
(505) 242-5354

be medium independent, and perform equally well with powerline, infrared, wireless, or most "none of the above" signalling schemes.

And, of course, the standard *must not* be at all proprietary or favor any particular manufacturer in *any* way. The standard *must* be fully open. With *all* documentation accessible.

Computer LAN networks certainly could be used for home control. Such as AppleTalk or Ethernet.

The only little problems have been their cost and complexity. Today, an Ethernet interface would double the price of, say, a bread machine. But prices are dropping rapidly. Time will tell whether these might eventually eliminate any need for any separate home automation bus standard.

Surely some musician somewhere is now running his kitchen toaster off MIDI. Giving a whole new meaning to having jam sessions.

The BSR code is a standard of sorts. This is well documented and more or less open. But, as we have seen, this code is pitifully slow, one-way only and has serious noise immunity and collision problems. I guess we could say this code is about the same as an 1890 aviation standard.

I know about three emerging home automation standards. One is the old *LonWorks* system from *Echelon*. To me, this is a grossly overblown example of megacorporations run amuck.

They started with the wrong micro family and applied it to proprietary bloated nonsolutions to nonproblems.

Did they do this on purpose?

A maverick home standard from out in left field is being honchoed by *Lone Wolf Technologies*. This one is clean, lean, and mean. But it may lack enough momentum to ever make it into the mainstream. This one sure is cute, though.

But the home automation standard that looks like it is going to run away with all of the marbles is called the *CE Bus*, short for *Consumer Electronics*. It's now *Open Standard IS-60*. Copies of which are gotten from the *Electronics Industries Association*, *The Information Store*, or *Global Engineering Documents*.

This bus is called a packet oriented, peer-to-peer network. It now supports powerline comm, infrared, wireless, twisted pair, coax, and fiber optics. A good summary story is *CEBus for the Masses*, in the April 1995 *Circuit Cellar Ink* on pages 61-68.

Sources for CE Bus info, software, and end products now include *Intellon, Arcatron, Micromint, Command Control* and *Cyberlynx*.

The CE bus is probably the one to bet on. At least for now.

Current Sensing

I'm utterly amazed that nobody has yet picked up on the key part needed for home energy management. This is a low cost remote current sensor that installs without using an electrician and without rewiring.

I first described these as an *Isopod* on back in HACK47.PDF. This was a tennis ball shaped device which you glomped onto your home power drop at the weatherhead. When prompted, it sends a digital word proportional to present current use.

Similar modules could also plug-in at any outlet. The receiver would pick up a reference voltage. Extracting real and reactive power.

Obvious uses are to dramatically reduce your power bill by finding out where and when most of your usage takes place. Or doing load shedding for better utility rates. Or for such odd things as servicing air conditioning intermittent problems.

Current sensors, of course, must sense current. While those *Hall Effect* devices might work, an old fashioned *current transformer* is probably all you need to do the job. Done properly, the current transformer should also be able to pirate enough energy to run a transmitter as well.

Amecon is one mid-range source for snap-on current transformers. But I sure have been intrigued by the new #273-104 snap-on chokes from *Radio Shack*. Around $3.50 each. With some care, you should be able to hack these into useful sensors.

Uh, I have not run those 60 Hertz permeability and saturation tests on their core material just yet. But, if it is manufactured from anything this side of ground up stove parts, they should work out just fine.

When you experiment with these, remember that a current transformer has to accept *one but not both* of the load wires. And you must *never* open circuit a current transformer.

This is an exciting new opportunity with a virtually unlimited market.

Magazines and Such

So far, I've found three good mags on home automation. The one I like the best is *Circuit Cellar Ink*. Their April 1995 has lots of useful info in it. They tend to have special quarterly home automation supplements.

Electronic House is a bimonthly pub that has been publishing since 1986. Targeting on advanced housing and home automation topics.

There is also a new *Home Automator* labor-of-love newsletter.

If your primary focus is alternate off-grid energy, *Home Power Magazine* does a really great job here.

And, speaking of alternatives, one outstanding series of videos on straw bale home construction is offered by *Black Range Films*. They also host a superb wilderness bed and breakfast. And networking that you simply will not be able to believe.

From *Alpha Centari*, even.

Another useful video is *Living With an Intelligent Home*. It is produced by *Home Systems Network*.

Which Microcontroller?

While a few older designers haven't gotten the message yet, there is one and *only* one chip to *ever* consider for home automation use. This, of course, is the PIC. Which completely, totally, and utterly blows the others away.

Start with the *Microcontroller Data Book* and *PIC Applications Manual* by *Microchip Technology*. Then go to the *BASIC Stamp* made by *Parallax*. And finally those superb *PIC Design Tools* from *Scott Edwards Electronics*.

By special arrangement with Lance Wally of Parallax, I've just uploaded the entire BASIC Stamp manual to my *GEnie* PSRT. It is yours free for the downloading. See BASTAMP1.PDF as an intro, BASTAMP2.PDF for stamp commands, and BASTAMP3.PDF for detailed applications info.

Acrobat readers are also available free for the downloading if you do not already have one. In PSRT library #10. These let you view camera ready documents directly on your computer screen. Much more on Acrobat in my MUSE89.PDF.

A complete listing of PIC resources is in HACK87.PDF. The instruction set is in MUSE88.PDF. And, of course, all the previous *Resource Bin* columns are also in the library.

Other Suppliers

MicroMint is one leading source of home automation electronics. Check out their *HCS II* and *SpectraSense 1000* product lines. They have got a brand new *Xpress Reference Manual*. Plus free BBS and catalogs.

Besides the previously mentioned books, *Home Automation Systems* also offers an *X-10 Applications Manual* and a unique *Building Interiors, Plants, and Automation* text for plant watering.

One useful source for the watering parts and systems is *RainDrip*.

Another automation distributor is *Home Control Concepts*. Who are also big on X-10 stuff, motion detectors, and intelligent remotes.

Other resources are *Home Systems*, *CompCo*, *Ademco*, and *Ja Mar*.

Drapery and window controls are offered by *Bautex*, *Cardiff*, *Solartronics*, *Makita*, *Marvin*, and *SM Automatic*.

Solar control products are available through *Zomeworks*.

High end consultants for architects and such include *Intellihome*, *Custom Command*, *Honeywell*, *Secant*, *Unity Systems*, *Home Automation Laboratories*, *Intelligent Systems*, *Mastervoice*, *Media Magic*, *Security*, or *Ken Wacks*.

A *Habitech95* home systems trade and training show is scheduled for May 17-20 in the Atlanta Apparel Mart and the Westin Peachtree Plaza.

There's also a new *Home Automation Association* trade group reachable at 75250.1274@COMPUSERVE.COM or by way of (202) 223-9669 voice.

This Month's Contest

I feel I might have missed a home automation supplier or two. For this month's contest, just tell me about any unmentioned resource.

Or, alternately, experiment with the #273-104 and show me what you can come up with in the way of a cheap, convenient, and electrician-free home automation current sensor.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For modem access: (800) 638-8369. When prompted, enter JOINGENIE. When asked for an offer code, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM

Don Lancaster's

RESOURCE BIN

number forty-one

Security and alarm industry resources.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle one super special signup deal for you *Resource Bin* readers. Ten free hours.

GEnie now offers far lower daytime rates, a direct Internet access, and a Windows graphics interface, so it's an even better deal than ever.

See the trailer blurb for details.

Alarms, Security and Such

This month, I thought we'd look at lots of alarm and security industry info. But before we do, note that some plain old common sense combined with *mid-level* security devices often are a better choice than overamping on the latest high tech gadgetry.

First and foremost, it pays to live in a part of the country which has a low and stable population. Having strong family and historic traditions. Around here, most local crimes do quickly get solved because nobody – but nobody – can keep their mouth shut in a small town. No way. No how.

And since everything is connected to everything else in any small town.

Six ways from Sunday.

Although I will admit that there are certain dark alleys here in Thatcher that you just do not dare go near late on any summer's night. If you leave your car running and unattended in one of these places, you are certain to return and find it filled with zucchini. In point of fact, zucchini pandering is considered one of the most heinous of Gila Valley offenses.

Besides being a national disgrace.

Second, you might want to seek out a lifestyle which emphasizes events, travel, studies, activities, and people rather than accumulating high profile things. Flaunting or "flashing" your possessions only invites ripoffs.

Besides *always* providing the *exact opposite* of your intended effect.

Third, note that if someone wants anything bad enough, they *will* rip it off. Every time. Here at the Thatcher Fire Department, we have this lil' ole skeleton key beastie called a *Broco*. A Broco opens *any* lock in eight seconds flat. It also successfully goes through 39 *trillion* vehicle alarm codes in that same eight seconds.

This Broco operates by the simple expedient of vaporizing anything that happens to be between where you are and where you want to be.

I've used this gem to quietly burn on through reinforced concrete. Even works really fine underwater. Simple and cheap. Anyone can buy one.

NEXT MONTH: Don looks at unusual desktop publishing supplies and opportunities.

Security devices do invite litigation. Should the color of your alarm panel clash with the intruder's shirt in some aesthetically offensive manner, your chances are pretty good you can be successfully sued. If the thief breaks his fingernail, you just might spend the rest of your life in court.

Some security devices simply do not work. Car alarms are an outright joke. Should one go off when your vehicle is being stolen, you just might go to jail for disturbing the peace or for creating a public nuisance.

As far as I've been able to tell, there is no one anywhere *ever* who went out and called their police whenever any auto alarm went off.

Uh, one of the worst examples of all times was that purportedly "secure" radio that Volkswagen tried foisting off on unsuspecting buyers. If your battery died, you had to go through a gruesome reprogramming sequence. Anyone (especially thieves) could call up VW and get the sequence. Except that you could never get it right in the allowable three tries.

Permanently disabling the beast.

Meanwhile, when your thieves find out the radio does not work, they get mad, return, and firebomb your car.

Which is a major trap: *Any* system or device that frustrates or angers an intruder could easily cause a lot more damage than it cures.

It obviously pays to avoid going to places or doing things that may invite confrontations. To avoid a tug-of-war, don't pick up your end of the rope.

Finally, *all* security devices do have hidden costs. Besides initial charges, there's user inconveniences, paranoia factors, and forced lifestyle mods. For instance, most anything that reduces your risk of a burglary also is likely to *increase* the consequences of a fire.

The ultimate bottom line question is simply: "Does the security device or system actually increase your security and peace of mind? Will it do so in a cost effective way?"

Much more on lifestyle approaches to security is found in the *Incredible Secret Money Machine II*.

Starting With the Obvious

The foremost resource of installers of anything everywhere, of course, is *W.W. Grainger*. Whose zillion outlets in all of the major cities stock nearly everything in the way of tools, wire, motors, or electrical parts.

For small electronic parts, try using *Mouser, Active*, and *Digi-Key*. The best resource for higher quality (but pricey) tools appears to be *Jensen Tools* , with *Techni-Tool* a close second.

For mechanical goodies, go to *Small Parts*. For everything your hardware store never heard of.

Or *McMaster-Carr* who operate the world's largest direct-mail hardware store. Playing in a city near you.

Naturally, you'll find lots of alarm and security stuff right here in *Nuts & Volts*. And three highly useful surplus sources include *American Science and Surplus*, *Herbach & Rademan*, and the folks at *Surplus Traders*.

Sweet's Catalog

Architects and builders have this giant directory that's vaguely akin to a *Thomas Registry*. It's called a *Sweet's Catalog*. In particular, check out their *Sweet's Building and Security Systems* 1995 catalog file. Covers such stuff as sitework, doors and windows, alarms, fire protection, and tv systems.

Security Distribution & Marketing

SDM magazine seems to be the best all around trade journal for the alarm and security industry. This is a thick and free controlled circulation mag. It averages 140 pages each month.

Lots of ads for just about all major security and alarm manufacturers.

Also for those regional distributors, trade shows, and industry comments.

Even kinks and hints.

Detailed how-to info is provided. One recent column revealed how to install waterflow switches and talked about home security automation.

Also Rans

There are scads of other alarm and security magazines. Let us do a brief rundown here…

Security Dealer is a smaller trade journal than SDM, but covers much of the same ground. Bunches of ads for motion detectors, control panels, and glass breaking detectors. *Security Sales* is a third journal which runs similar ads and technical info.

Security is another industry trade journal. A recent issue covered video motion detectors, covert wireless, and photo ID system setup.

Security Technology & Design is big on door hardware and closed circuit tv stuff. *Security Management* is mostly for those manning the larger alarm and industrial patrol systems.

Security News is a monthly tabloid newspaper by *Terra Publishing*. Often a few dozen pages or so, this journal includes both classified and regular ads, news of upcoming shows, and legislative issues.

Electrical Contractor is an oversize tabloid. Although not alarm-specific, its got lots of useful bits-and-pieces product info in it.

Distributors

There are many dozens of firms who distribute the alarm and security devices for installers and consultants. Among the many others, these include *Ademco, D & J Products, King Alarm*, and *Mountain West Alarm*.

One outfit that specializes in tools and products for wire pulling is *Music Supply*. The personal safety alarms are offered by *BeepAlarm*. For automatic locking door hardware, try *Monaco*.

For sensors and contacts, try *Tane Alarm Products*. *Ultrak* supplies ir and microwave people detectors.

For investigation and surveillance books, see *Intelligence Incorporated*. For covert cameras, *RNJ Electronics*.

Additional sources advertise in the trade journals I've just mentioned.

Automotive Stuff

The leading journal here appears to be *Installation News*. Which is also big on car radio and audio. One popular newsstand magazine is *AUTOtronics*. Who often include security resource listings. Also lots of ads.

A pair of coded car alarm sources include *Alarm Electronics* and *Vehicle Security Electronics*. A source for those run-flat tires and other serious vehicle security devices is *Hutchinson*.

Fire Protection

Your leading fire sprinkler trade journal is *FPC Magazine*, short for the *Fire Protection Contractor*.

Their competition is *Sprinkler Age*, the official publication of the *American Fire Sprinkler Association*.

The fire service magazines can also be of use. My favorite one by far is *Fire Engineering*. Your primary trade organization is the *NFPA*, or *National Fire Protectoin Association*.

Lock Picking

The most prestigious journal here is *Safe and Vault Technology*. Which is the official publication from that *Safe and Vault Technicians Association*.

But the clear winner seems to be a thick magazine going by the name of

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(800) 573-0154

AIM
1326 Freeport Road
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(412) 963-8588

Alarm Electronics
Route 2 Box 99-1
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(800) 444-3365

Allegro Micro Systems
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The National Locksmith.

Both of these mags provide detailed step-by-step safecracking information.

Access Control

Keyless entry systems and such are covered in depth by a freebie trade journal by the name of *Access Control*. Your related trade journals involving barcoding and identification include *Automatic I.D. News*, *I.D. Systems*, and *Identification Journal*. There's also the *AIM* group, short for the *Association of Identification Manufacturers*.

One manufacturer of specialized security chips is *Dallas Semiconductor*.

A second source is *Allegro/Sprague*. Chip applications often show up in *IC Card Technology* magazine.

Newsletters

There are great heaping bunches of security newsletters. These are often outrageously overpriced, given what they deliver. But, on the other hand, might be just what you need. You'll find a complete listing in the *Ulrich's Periodicals Dictionary*, available online at *GEnie* or on the reference shelf of your local library.

These mostly do tend towards high end corporate security problems.

Random examples include *Privacy and Security 2001*, *Corporate Security Technology Alert*, *Security Director's Digest*, *Security Business*, *Special Police Legal Update*, the *Personal Identification News*, and *School Security Report*.

The latter also provides individual reports for hospital, parking, campus, hotel, motel, and health care.

Trade Shows

There are quite a few regional trade shows for alarm and security insiders. Notices of upcoming events appear in *SDM*, *Security Dealer*, *Security Sales*, *Security*, and *Security News*.

A major putter-onner of security shows is *Reed Exhibition*. Contact them for a list of current happenings.

A second show is called *CardTech SecurTech*. On everything from smart cards to mag stripes to devices for rf identification. You just missed a big show, so get on their mailing list for the next one in your area.

One show you can still catch is the *ASIA* show from the *American Society for Industrial Security*. This one is more for larger firms and institutions, but it includes many educational sessions. September 11-14. Somewhere in New Orleans. Uh, their brochure does not seem too specific in the exact address, but the New Orleans Hilton is their headquarters hotel.

I guess its their way of keeping the show secure. Sigh.

Widdle Brudder

I don't get into security installation or design all that much. Since I very much feel that common sense lifestyle factors and self-insurance could make such a big difference. But my widdle brudder Jeff over at *Premier Security Systems* is one fine security specialist. Who offers all you'll need in the way of consulting, installation, design, or service. Give him a call.

A second individual I can highly recommend is Wyatt Palmer of *Valley Security* here in Thatcher.

As in any field, there's good guys and bad guys. So always get several personal referrals before you commit any big bucks to anyone.

This Month's Contest

Let's do three contests this month: (A) Clue me in to any security device or resource I do not know about. Or else (B) tell me some security story. Horror or humor. Or (C) let me know your ultimate solution to the zucchini problem. This one's tough.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

Some additional alarm and security info appears in HACK19.PDF on my *GEnie* PSRT. You'll also find reprints of previous columns here as files NUTS01.PDF through NUTS42.PDF.

Yes, you can even get an advance peek at new columns before they hit the newsstand racks.

These are also still available as my *Resource Bin* hard copy reprints from *Synergetics*. Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For modem access: (800) 638-8369. When prompted, enter JOINGENIE. When asked for an offer code, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM

Don Lancaster's

RESOURCE BIN

number forty-two

Alternate desktop publishing opportunities.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle one super special signup deal for you *Resource Bin* readers. Ten free hours.

GEnie now offers far lower daytime rates, a direct Internet access, plus a Windows graphics interface, so it's an even better deal than ever.

See the trailer blurb for details.

The Alternate Desktop

Several months ago, we looked into *Book-on-demand* opportunities making use of PostScript and laser printers. This month, I thought we might take a quick look at papers.

And then focus on desktop's "other stuff" category. Obscure goodies you can use PostScript and a printer for to make a buck or fill some community need. Stuff that requires only a few nickels worth of supplies and takes a few minutes of your time to create a unique personal product...

Paper Sources

Just in case you hadn't noticed, the price of paper just doubled in the last twenty minutes. On the other hand, there are lots of new papers that are more laser friendly, more permanent, and in far more colors, weights, and styles than ever before.

Start with a local store in the *Paper Plus* chain. Or check into the dozens of laser-specific direct mail outfits that stock mind-boggling selections.

But at somewhat higher prices.

A random sampling includes *Paper Access*, *On Paper*, *Impact*, *Paper Direct*, *Queblo*, *Premier*, *Great Papers*, *Beaver Prints*, *Paper Design*, *Quill*, *Viking*, and *Paper Adventures*.

Badges

Custom badges can be simple and cheap to do. Parts cost can be as little as twelve cents each.

The most obvious source here is *Badge-a-Minit*. Who offer all sorts of free catalogs and clip art. Plus a $29 startup kit. One cheaper parts source is *Super Badge and Button*.

One major warning on using those Badge-a-Minit presses: Get some help from a five year old child! They will instantly *glomp-snip-glomp-snap* any badge for you.

Any adult puzzling over the same process will take several hours.

An alternate circle cutter that works better is the *NT Cutter C-1500P* sold by *Clotilde*. Either circle cutter works best over a plastic cutting mat.

NEXT MONTH: Don looks at old and new resources for electronic music.

Circular justification routines are found in KCIRCTEXT.GPS.

A variant on badges are cups and mugs that accept "drop in" graphics. *Neil Enterprises* and *Inkadinkado* are two leaders here.

Business Cards

Cutting custom business cards used to be real bad news. Besides being a tedious hassle, if you were off even a little bit, the cards looked awful.

Today, there are all sorts of precut business card blanks. Two examples include *Cards Now* and *Blanks USA*. Do note that their layouts are slightly different. Different programming is required for either system. Also note that you can print a dozen cards per page with your own routines but only ten with commercial blanks.

Card durability could get improved with *Laser Buddy* spray, laminating, or *Bakerizing*. With Bakerizing, you place your cards (or other toner product) in contact with a gloss mylar sheet and apply heat and pressure. Which will calender the finish.

Making all the toner unbelievably glossy, durable, and black.

A sneaky trick I've used to pick up spot color: Print bold characters white on any solid black background. Then, use ordinary page highliters to color the characters. On the latest printers, most of the blacks are dense enough to *completely* erase the overprint. You end up with pastel over black.

Obvious other approaches to color include color papers, color toners, or those hot stamp foils.

Yeah, plain old business cards are available cheap in quantity. And it is hard to beat those $9.90 per thousand thermography versions that advertise in the business mags. But what you could do is offer instant availability of just a few cards. Better yet, you could offer personal graphics the big guys won't dream of touching.

Ferinstance, *maps* are easily added to any custom business card. And the potential for personal "Here's how to get to our house" cards is still largely untapped. And wide open.

See GURU41.PDF for further details. Additional card layout utilities are in BLANKSUSA.GPS, CARDSNOW.GPS, PCARDADD.GPS, and NUTS12.PDF.

Stepping & Repeating

The key secret to any smaller sized speciality desktop product is a strong *step and repeat* routine. Which lets you,

ferinstance, do 10 to 12 business cards, half a dozen badges or three bumper stickers on each sheet.

But simply any old repeating utility won't do. What you really want is a step-and-*almost*-repeat. This one lets you make up sequentially numbered tickets, or automatically customizing awards with your recipients' names. Sequential entries in a special array get used to customize each result.

I have posted the step-and-repeat routine I use as STEPNRPT.PS. There are dozens of templates here.

Padding Compound

Magic *Padding Compound* glop lets you do a removable binding for such things as note pads or calendars. In our PostScript class, prescription pads seemed real popular.

All of your sheets *must* get jogged before padding. Preferably by using a real printer's jogger.

After jogging, you can clamp your sheets in a homemade squasher and paint the edge with the glop. Two or three thin coats are better.

Then dry overnight. A giant stack can be padded at once and then torn apart into individual projects.

One welcome and cheap gift is to take any stack of Astrobright papers, and add a child's custom name to the top sheet. Perhaps as "Melissa's very own paper" and some crayon art.

Or the ultimate padding compound ploy: Go to the bank and get yourself 100 new and sequentially numbered one dollar bills. Then long edge bind them using padding compound. Add a "time to reorder" form between bills number 20 and 21. And add the usual cardboard sheet on the bottom.

A tip on smaller prescription pads: Do the step and repeat in such a way that your to-be-bound edges all end up *portrait left* and *portrait right*.

Certain jobs will end up rotated or flipped on the page.

Then pad up the full stack of whole sheets at once. Finally, cut the pads to size. This shares your clamping and padding labor efforts.

Padding compound is available for around $6 a quart from *Paper Plus* or just about any printing supply house. While white and pink are the stock colors, you can add ink or easter egg dye to the white for full color.

Custom Post-It Notes

Those "Post-it" notes are related to padding compound. You can buy the removable adhesive glop in roller or liquid form at a large office supply. While *3-M Post-It* does make nine-up notes for laser printing, these can be costly and hard to find.

Another alternative is to print the outlines of several post-it notes onto a carrier, stick the notes extactly to the outlines, and then send it through a laser printer. This gets handy for full custom on oddball colors.

Hot Stamp Foils

This stuff used to be known as *Kroy Color*. Toner is a thermoplastic glue as well as a coloring agent. Should you put hot toner in pressure contact with a hot stamp foil, the toner will remelt, grabbing to the foil. The result can convert toner into brilliant colors.

Brights, pastels, or metallics.

Most direct mail paper sources do offer the small quantity foil kits. The simplest method is to tape a precut piece of foil on a select toner area, and run the sheet back through any laser printer having a straight path.

Sadly, there was this chicken-egg problem that kept all this stuff from really taking off. The special machines (which require very careful control of temperature and pressure) remained outrageously expensive and hard to get. And the sheets themselves tend to be way overpriced.

All of which still leads us to a great untapped opportunity. Sources of hot foils include *Crown Roll Leaf*, *Hoechst*, and *Transfer Print Foils*. The latter has a great *Foiled Again* newsletter.

There's also a hot stamp foil trade journal called *Inside Finishing*.

A superb source for intermediate quantities of foil rolls is *FoilMax*. You can find more on building your own foil fusion machines in HACK11.PDF or in GURU43.PDF.

Rubber Stamps

"Rubber" stamps are not made from rubber. Chemical *photopolymers* get used instead.

Because of the photo process, you can image *any* combination of text, clip art, and custom graphics you like.

Even photos.

To make a stamp, you first create a 1:1 negative of your desired artwork. Direct PostScript laser printing onto polyester works just fine.

A fairly thick photopolymer layer gets spread out and carefully spaced between two glass panels. The first side is then flash exposed *without the negative* with uv light. The exposure time is selected to precisely harden

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Wyndstone
1400 East Touhy Ave #475
Des Plaines IL 60018
(708) 297-2330

one half of the polymer thickness.

You'll then flip your photopolymer over. This time, you expose *through* your negative. This creates a "mesa" effect, where the entire bottom of the stamp is hardened, sloping on up to a precise artwork match.

The remaining liquid polymer is then washed out, followed by another exposure to complete the hardening. You then add the usual soft backing and a suitable handle.

To make the process economic and worthwhile, you normally will make a larger sheet with bunches of stamp projects on it. These can then be cut up into individual stamps.

The usual starting point on all this is *Grantham Polly-Stamp*. In medium quantities, the glop is available from *R. A. Stewart*. For railroad tank car lots, use *Hercules-Merigraph*.

Do-it-yourself stamp projects are in our *PostScript Beginning Projects*.

The big boys use *flexographic* plates instead. Which are just giant rubber stamps, optimized for press uses. And often used for such things as printing shipping cartons and such. A review of photopolymers in general appeared back in HACK66.PDF.

Silk Screening

The silk screening process gets used for everything from T-shirts to posters to advertising signs to greeting cards to playbills to circuit boards.

Traditionally, original artwork got photographed and processed. Ending

up with a silk or metal screen having holes where ink is to go and blockout where ink is to be stopped.

The screen is then tightly stretched into a hinged frame, and gets held a fraction of an inch above what you are printing. A squeege forces special ink on through the screen. Contacting only where pressure is applied.

Some inks air dry. Others cure with heat or ultraviolet light.

Two major suppliers of silk screen products are *Southern Sign Supply* and *Advance Process*. The leading mag is *Screen Printing*. One direct mail source for smaller quantities is *Dick Blick*. Two trade journals specific to T-shirts are *Impressions* and *PrintWear*.

One ultra low end artsy-craftsy silk screen creating machine is *Gocco*. And available from *Think Ink*. An ordinary flashbulb is used to expose the film.

If you really want to go whole hog, *Gerber* makes an incredible PostScript to silk screen mastering machine. It functions sort of like a inkjet printer. Except that your blocking resist goes directly onto the screen itself.

Precise multi color, too.

All the photo chemistry and all the slopping in the slush is eliminated in one swell foop. This one is expensive.

About the same as a new car.

"Fuzzy" lettering and such can be done using a sneaky process called a *hot split plastisol*. Any letter, such as a football jersey number, becomes heat bonded to the fabric. While it is still hot, the letter is literally rent asunder. Leaving half of the chemistry on the backing sheet and half of it on your fabric. The violent tearing gives you the final fuzzy surface. The leading supplier of this sort of stuff is *Stahl's*. They've also got several free videos available on their offerings. *Gerber* also stocks large quantities of hot split plastisols. And related inks.

Direct thermal transfer materials are also available. Try out *Wyndstone*. Or check into the *Transfer Magic*.

When you are instead interested in "instant felt" flocking, one supplier is *Don Jer*. The old way was to apply liquid glop and then spray on all the flock itself with a cabbage duster type of beastie. A second route is offered by *Hop Industries*. Who offer precut and prepatterned transfers.

More on flock in GURU74.PDF.

Pad Printing

One really obscure alternate to silk screening is known as *Pad Printing*. Pad printing gets used for advertising specialties and such. It is particularly useful for printing on 3-D surfaces. Even eggshells can be pad printed.

To pad print, ink gets placed on an etched plate called a *caliche*. And then wiped using a *doctor* blade. A silicon rubber pad picks up the ink and then rolls it onto your pen or golf ball or whatever. A carefully chosen *involute* pad shape prevents distortion.

Suppliers do include *Barton-Nelson, Print Central, Service Tectonics,* and *Basco*. One source for etched plates in general is *Owosso Graphics*

More on pad printing is found in PADPRINT.TXT and GURU59.PDF.

Other Opportunities

For *thin* self-stick full color photos in various sizes, *PhotoLabels*. For glass etching *Armour Products, Professional Glass Consultants, National Sandblast,* or *Victory Glass*.

For quality embroidery machines, one leader is *Meistergram*. For metal signs or dials, *Fotofoil, Metalphoto,* or *3-M Dynamark*. For vinyl signcutters, *Roland* or *Gerber*.

For glow-in-the-darks, prismatics, holographics, and whatevers, *Coburn*. For heavier material stock in general, *FomeBords*. For applications help, the *POP &Sign Design* mag.

Your cheapest and best source for lamination machines and materials is *USI*. Also check pricey *GBC*.

For tickets, *Quick Tickets* or *Ticket Express*. For stock die cuts, *Die-O-Perf* or *Blanks USA*. Free samples.

Low cost scoring systems by *Martin Carbone.* Also *H.S. Boyd*.

Special scissors for fancier paper edging from *Back Street Designs*. A big warning here: Seamstresses will react violently when you even glance sideways at their pinking shears!

For heavier, high gloss and brightly colored laserpapers: *LaserCraft* from *Darcy Paper*. Great stuff.

For laser printer parts and training, *Don Thompson*. For effective binding systems *Unibind*. Especially their new *Pentabind* product.

For certificate stock, use *Paper Plus* in small lots. Or *Goes Lithography* or *Action Communications* in bulk.

For custom consulting and design on products that successfully sell in a small town, *Special Editions*.

This Month's Contest

Let's have two contests this month. Either (A) Tell me about an alternate destop opportunity or resource I do not yet know about, or (B) Dream up the most fiendish possible routine to go with the "dollar ripoff" ploy.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

For More Information

The dozens of free printshop trade journals are superb starting points for exploring alternate desktop concepts. *Quick Printing* is pretty near the best. Especially its *Helene's Helpline* product locator service. *Instant Printing* can be a second good choice.

My favorite two regional printer's classifieds are *California Printer* and *Horse Trader*. The *Printer's Hot Line* is a useful nationwide pub.

There are several more.

Plus, of course, *Recharger Magazine*. Printer's shareware is available from an outfit that goes by the catchy name of *Printer's Shareware*.

But note that *Printer's Shopper* is *not* a shopper at all. It is instead a useful wide range and a full line catalog of print supplies. Most at list price.

Of my own products, my *PostScript Beginning Projects* and *Book-on-demand Publishing Kit* can give you lots more insider info. You can check my nearby *Synergetics* ad for details.

Or call me for details. There's lots I had to cut to get this column down to size. Bumperstickers, announcements, custom papermaking, and more.

Besides the mentioned files, there's bunches more up on my *GEnie* PSRT. Plus preprints and reprints of all my columns and stories.

Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

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You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM

Don Lancaster's

RESOURCE BIN

number forty-three

Electronic music then and now.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle one super special signup deal for you *Resource Bin* readers. Ten free hours.

GEnie now offers far lower daytime rates, a direct Internet access, plus a Windows graphics interface, so it's an even better deal than ever.

See the trailer blurb for details.

Electronic Music

Electronic music is a rather highly technology driven field. Defined by what was possible at the time.

Several goals do include: Producing sounds that are not restricted to the physics of acoustic resonance.

Reducing costs of orchestral, video, theater, CD and motion picture sound production. Adding sound and music to computers. Enhancing a traditional instrument. Creating new sounds.

The earliest electronic music device was an instrument called a *Theremin*. This dates from the late 1920's. There were two radio frequency oscillators, each connected to sensitive antennas.

Bring your hand near one antenna to change the *pitch*. The other varies *loudness*. Playing in mid air.

Traditional Theremin sources often do advertise in *Sound Practices*. *PAIA Electronics* has new Theremin kits.

Next came electronic organs. They usually started off with a *Top Octave Generator* which produced the twelve notes of the highest octave. Cascaded binary divider chains then produced lower frequency sawtooth waves.

A sawtooth wave has all harmonics present and rather strong. Suitable filters could emphasize or reduce any given harmonic to voice the various organ pipes or instruments.

The rule was to use sinewaves for flutes, square waves for woodwinds, and sawtooths for strings.

The "locked in" nature of the notes and the limited note envelopes very much defined the obtainable sounds. The best early book on these was the classic *Electronic Music Instruments*.

Authored by Richard Dorf.

A source for replacement parts and organ electronics is *Fistell's*.

By far the finest of all the electronic organs was (and remains) *Allen*. Who went so far as to produce a separate oscillator for every note, simulated air supply variations known as *electronic whind*, and even a *chiff*, that sudden startup transient when a traditional organ pipe gets hit with a burst of air. An outstanding read on this is *Trials and Triumphs of an Organ Builder* from Allen's *Vox Humania Press*.

NEXT MONTH: Don looks at national and local resources for the physically disabled.

Moog and Company

Next in line was the era of the *Moog Synthesizer*. Using analog VCO *voltage controlled oscillators*, VCA amplifiers, and VCF filters. VCO's set your pitch, driven from a keyboard voltage.

Those VCA's set the attack-sustain-decay envelope of the note. The VCF's created the note's timbre.

All VCO's had to be stable and have a wide *log* range. Major problems did include stability and the restriction to *monophonic* single notes.

One supplier for traditional analog SSM synth chips is *PMI*.

The next electronic music milestone got reached when this person by the name of Chowning made an amazing discovery. By *frequency modulating* a note, different harmonics result.

All this happens because of certain obscure properties of all those *Bessel Functions* underlying FM modulation. You could now create different tonal colors without needing either fixed or tracking filters. On the fly.

Round about the same time, others decided to work out from the supply side. Designing all sorts of personal computer software products. Which let you compose, translate, and print musical scores. The *Sonata* font from *Adobe Systems* was one example.

Along with MIDI links between pc's and intelligent instruments.

As with all other electronics, the switch to digital became inevitable. Digital once and for all solved the old polyphony problems. Because your keyboard was now isolated from the tone generators. A pressed key gets a generator assigned. That assignment continued until the note's decay.

Also new to digital was the concept of *wavetable synthesis*. Where the note harmonics and its envelope could be stored and executed separately.

Wavetable synthesis also drew no distinction between traditional tones, speech, or even oinking pigs. It was a totally generalist solution to creating variable pitch and amplitude.

The early leader here was *Ensoniq*. Whose chips went into nearly all of the mainstream synthesizers. Not to mention such computers as the Apple IIGS and many others.

Ensoniq never seemed too excited about selling individual chips. Since that time, *Integrated Circuit Systems* has become a leading supplier of low

cost digital synthisizer chips.

Yet another source of digital synth chips is *Yamaha*. A fourth significant resource here is *Crystal Semiconductor*, the foremost supplier of high quality delta-sigma A/D converter chips.

Competing with Crystal are *Analog Devices* and *Burr-Brown*.

About this time, the toy music all of a sudden started sounding real good. Letting certain $39 consumer products outperform $8000 electronic organs.

These days, we're in the midst of a *Digital Signal Processor* revolution. In which the entire sound gen system is totally flexible, fully programmable and software driven.

MIDI

The centermost key to *everything* even remotely electronic musical is called MIDI. MIDI is an asynchronous 31.5 kilobaud channel remarkably similar to plain old serial computer comm. The main two differences are the strange baud rate and the ability for several *addressible* sites to share the same serial channel.

MIDI commands typically specify a note, its envelope, and its duration. MIDI also can get used to upload or download presets. Or anywhere else you'll want to exchange intelligence between music modules, instruments, or even entire orchestras.

There's a dozen good MIDI books out. The oldest and finest is Craig Anderton's *MIDI For Musicians*. The Internet primary MIDI home page is **HTTP://WWW.EEP.ELE.TUE.NL/MIDI.INDEX.HTML**

Roland offers a free newsletter on their MIDI products. Also see the 88 page *Computers & Music* catalog.

Electronic Musician

The most obvious mainstream pub is, of course, *Electronic Musician*. A monthly mag chock full of reviews, theory, and commercial ads.

A recent issue covered such topics as multimedia careers, the review of online commercial services, and hot new DSP plug ins.

MIX Bookshelf

Electronic Musician also publishes *MIX* magazine for sound recording studios. Together, they also offer the *MIX Bookshelf*. Which now stocks *the* definitive collection of pretty much everything on electronic music, MIDI, audio, and video recording.

Their free catalog is a must. One excellent beginning book is *Electronic Projects for Musicians*.

PAIA Electronics

The long time leader in lower end electronic music kits, *PAIA* offers a wide variety of unique products.

By musicians for musicians.

Three current projects are their *Fat Man Analog MIDI Synth*, their brand new Theremin kit (you did see it here first), and their "vacuum tube sound" front end preamps.

Free catalogs are offered. See below for their web home page.

Many thanks to PAIA honcho John Simonton, who contributed several key resources to this column.

JASA and JAES

Much in the way of original tech research and "horses mouth" music papers comes down in a pair of classic journals. The older of the two is JASA, or the *Journal of the Acoustical Society of America*. The newer is the *Journal of the Audio Engineering Society*.

Experimental Musical Instruments

This is one superbly well done and little-known magazine. While mostly about strange new ways of blowing on a gourd or twanging a coat hanger, both electronics and traditionals are covered in depth.

Online Resources

Most current electronic music info appears online these days. Including the music itself. Let's look at a few more examples…

http:///www/paia.com.paia is quite strong on electronic music kit support.

http://rowlf.cc.wwu.edu:8080/~n9343176/schems.htms focuses on their schematics for guitar effects and related stomp boxes.

http://www.hyperreal.com/machines has lots of synthesizer schematics.

http:///www.hk.net/~prs.midi.html publishes the *Archives of Classic MIDI Sequences*.

http://www.galaxy.einet.net/hytelnet/ful063.html is a music and brain info database.

http://www.cecer.army.mil/~burnett/MDB is a data base on commercial music albums.

telnet: runner.utsa.edu login: imr provides the *CARISS* or *Computer-Assisted Retrieval Service System for Music*. Which covers music medicine and music therapy.

anonymous ftp: ftp.uwp.edu; path: pub/music is a music archive on artists, discography, lyrics, and pictures.

rec.music.makers.builders is the newsgroup for instruments and electronics.

rec.music.makers.synth is one newsgroup with useful homebrew info in it.

To subscribe to the *synth-diy*, mail

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LOTS OF OTHER GOODIES

Ask the Guru I or II or III	$24.50
Hardware Hacker II, III or IV	$24.50
Micro Cookbook I	$19.50
PostScript Beginner Stuff	$29.50
PostScript Show and Tell	$29.50
Intro to PostScript Video	$29.50
PostScript Reference II	$32.50
PostScript Tutorial/Cookbook	$19.50
PostScript by Example	$32.50
Understanding PS Programming	$29.50
PostScript: A Visual Approach	$22.50
PostScript Program Design	$24.50
Thinking in PostScript	$22.50
LaserWriter Reference	$19.50
Type 1 Font Format	$16.50
Acrobat Reference	$24.50
Whole works (all PostScript)	$380.00
PostScript Insider Secrets	**FREE**
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Ongoing details on Book-on-demand publishing, a new method of producing books only when and as ordered. Reprints, sources, samples. **$39.50**

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For most individuals, patents are virtually certain to result in a net loss of sanity, energy, time, and money. This two volume set shows you tested and proven real-world alternatives. **28.50**

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The reprints from all Don's Midnight Engineering columns. Includes a broad range of real world, proven coverage on small scale technical startup ventures. Stuff you can use right now. **$24.50**

RESOURCE BIN I
A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. **$24.50**

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Well, nearly free anyway. Almost. Do join us on GEnie PSRT to sample all of the Guru's goodies. The downloading cost on a typical Guru file is **21 cents**. Modem access: Dial (800) 638-8369. On prompt, JOINGENIE, then DMD524 on key.

FREE VOICE HELPLINE VISA/MC

SYNERGETICS
Box 809-NV
Thatcher, AZ 85552
(520) 428-4073

Write in 146 on Reader Service Card.

ELECTRONIC MUSIC RESOURCES

Adobe Systems
PO Box 7900
Mountain View CA 94039
(800) 833-6687

American Organist
475 Riverside Drive Ste 1260
New York NY 10115
(212) 870-2163 FAX

Analog Devices
PO Box 9106
Norwood MA 02062
(617) 329-4700

Audio Amateur
Box 576
Peterborough NH 03458
(603) 924-9464

Burr-Brown
6730 S Tucson Blvd
Tucson AZ 85706
(602) 746-1111

Clavier
200 Northfield Road
Northfield IL 60093
(708) 446-5000

Computers & Music
647 Mission Street
San Francisco CA 94105
(800) 767-6161

Crystal Semiconductor
PO Box 17847
Austin TX 78744
(800) 888-5016

Diapson
380 E Northwest Hwy
Des Plaines IL 60016
(708) 298-6622

Early Keyboard Journal
Box 32022
Charlotte NC 28232
(919) 842-4322

Elderly Instrument
1100 N Washington
Lansing MI 48901
(517) 373-7890

Electronic Musician
6400 Hollis St #12
Emeryville CA 94608
(415) 653-3307

Ensoniq
263 Great Valley Pkwy
Malvern PA 19355
(215) 647-3930

Exp Musical Instruments
1700 Old Rancheria Rd
Nicasio CA 94946
(415) 662-2182

Factsheet Five
R Seth Friedman
PO Box 170099
San Francisco CA 94117

Fistell's Microelectronics
7023 E Colfax
Denver CO 80220
(303) 393-6000

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

Glass Audio
PO Box 876
Peterborough NH 03458
(603) 924-9464

Guitar Player
20095 Stevens Creek
Cupertino CA 95014
(408) 446-1105

Integrated Circuit Sys
PO Box 968
Valley Forge PA 19482
(610) 630-5300

Journal AES
60 E 42nd St Rm 2520
New York City NY 10165
(212) 661-2355

Jnl Am Organbuilding
Box 130982
Houston TX 77219
(713) 529-2212

Journal ASA
335 E 45th St
New York City NY 10017
(212) 661-9404

Keyboard
20085 Stevens Creek Blvd
Cupertino CA 95014
(408) 446-1105

Mechanical Music
887 E Orange Avenue
St Paul MN 55106
(612) 774-2490

MIX Bookshelf
6400 Hollis St #12
Emeryville CA 94608
(800) 233-9604

Modern Keyboard
1115 Broadway 8th FL
New York NY 10010
(212) 807-7100

Music & Sound Retailer
25 Willowdale Avenue
Port Washington NY 11050
(516) 767-2500

Music Retailing
70 Rt 202 North
Peterborough NH 03458
(603) 924-0058

MMR/Musical Merch Review
100 Wells Avenue
Newton MA 02159
(617) 964-5100

PAIA Electronics
3200 Teakwood Ln
Edmond OK 73013
(405) 340-6300

Pedal Steel News
Box 248
Floral Park NY 11001

Piano Technicians Journal
3930 Washington Street
Kansas City MO 64111

Play Meter
PO Box 24970
New Orleans LA 70184
(504) 488-7003

Player Piano Company
704 E Douglas
Wichita KS 67202
(316) 263-3241

PMI
1500 Space Park Dr
Santa Clara CA 95052
(800) 843-1515

Ragtime
4218 Jessup #AB
Ceres CA 95307
(209) 668-0366

Reed Organ Society Bulletin
6907 Rix Street SE
Ada MI 49301
(616) 676-1188

RePlay
22157 Clarendon St
Woodland Hills CA 91365
(818) 347-3820

Roland Digital
7200 Dominion Circle
Los Angeles CA 90040
(213) 685-5141

Rough & Tumble Engineers
Box 9
Kinzers PA 17535
(717) 442-4249

Sound Practices
Box 180562
Austin TX 78718
(512) 339-6229

Synergetics
Box 809
Thatcher AZ 85552
(602) 428-4073

Theater Organ
Box 417490
Sacramento CA 95841
(916) 966-3172 FAX

Tracker
Box 26811
Richmond VA 23261
(804) 253-9226

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

Vox Humania Press
150 Locust St
Macungie PA 18062
(215) 966-2200

Yamaha
6600 Orangethorpe Avenue
Buena Park CA 90622
(714) 522-9011

majordoma@horus.sara.nl' then you *subscribe synth-diy <your.email.address>*. This is a new synthesizer resource.

To subscribe to *Bode*, route mail to **magordoma@veda.is** followed by a *subscribe bode <your.email.address>*

To subscribe to *analogue.heaven*, use **majordomo@hyperreal.com**

Commercial online forums include America Online's SSS, plus GEnie's MIDI (an 8000+ file library) or their MUSIC (5000+ files) RoundTables.

Special Musical Interests

There are zillions of music special interest magazines, newsletters, and trade journals. As always, your best starting point is using that *Ulrichs Periodicals Dictionary*, available on line or at your local library.

A second great source for the *really* off-the-wall stuff is *FactSheet 5*.

Vacuum tube traditionalists should find *Glass Audio* and *Sound Practices* of interest. All any vacuum tube does is unreliably and inefficiently add hum, noise, and distortion to an otherwise clean audio channel.

A surprisingly large number of my helpline callers are building their own real pipe organs. Important resources here do include the *American Organist*, *Clavier*, *Diapson*, *Tracker*, *Journal of American Organbuilding*, the *Reed Organ Bulletin*, and *Theater Organ*.

Older musicians should appreciate *Elderly Instruments*, or else that *Early Keyboard Journal*. Younger ones might favor *Guitar Player*, *Modern Keyboard*, *Pedal Steel News*, and *Keyboard*.

Hobby music projects often appear in *Popular Electronics*, *Electronics Now*, *Nuts & Volts*, and *Audio Amateur*.

For player pianos, *Mechanical Music* or the *Piano Technicans Journal*. Three good parts sources include *Player Piano Company*, *Rough and Tumble Engineers*, and *Ragtime*. For modern coin-op stuff, *RePlay* and *Play Meter*. We saw lots on jukebox resources in HACK73.PDF on my *GEnie* PSRT. And in the *Hardware Hacker* reprints.

The main music store trade journals do include *Music and Sound Retailing*, *Music Retailing*, and *MMR*.

For actual music production, try out *Recording* and *Mix* magazines.

This Month's Contest

I used to publish lots of homebrew electronic music projects way back in *Popular Electronics*. Circa 1965-1973. But since I can not carry a tune in a bucket, I have tended to lose touch with the latest in the field.

So, for this month's contest, just tell me about any new electronic music resource I don't know about.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

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Don Lancaster's

RESOURCE BIN

number forty-four

Disabled and handicapped resources.

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Handicapped Resources

This month, I thought we'd take a look into resources for the disabled. High tech and otherwise. But before we begin, here are several politically incorrect guidelines which I do feel definitely need to be said…

Firstoff, just about any third-party disability situation appears bound to involve psychic energy sinks, guilt, or bad vibes. Pathos 101. The foremost rule is to *separate the baggage from the problem*. So, the *only* reason to involve yourself is *because you want to.*

It is not your problem, unless you *personally* choose to make it so.

Second, I do not see there is any point whatsoever in developing *any* handicapped product or service *unless you have specific, long term, and first hand knowledge of the problem*.

Otherwise, you are *certain* to end up with what those french veterinians call a *four paw*.

Third, recognize that institutions that supposedly "help" the disabled may have hidden goals and agendas. Such as a school lumping the truly gifted right on down with the epsilon minuses. And then treating both of them as "special" problems.

Fourth, many laws and regulations involving disability issues range from woefully cost ineffective on down to outright ripoffs. Outright ripoffs that benefit nobody but bureaucrats. It is insane to add $50 to the cost of a tv set when a seventeen cent connector (and an optional card for a tiny minority of the sets) can do a better job.

A strong case can be made that the sole purpose of ADA is to cripple and handicap small business.

Finally, and most important, most disability subjects have long ago been thoroughly discussed. All you have to do is look. Some ferinstances…

Disability Bookshelf

In the past, we looked at a number of those special interest direct mail bookshops which literally defined the resource center for a topic. That *SAE Library* for cars, the *Mix Bookshelf* for music and audio, *Lindsay Publications* for "lost" technical lore, *Navtech* for GPS navigation, and so on. A lot more on these in my *GEnie* PSRT.

NEXT MONTH: Don looks at mightily manic multimedia magazine madness.

One definitive resource here is the *Disability Bookshelf*. They stock over 400 titles, along with videos, cassettes, and talking books.

Any information quest should start off with their $5 catalog.

Trace Center

This one is run by the University of Wisconsin. Start with their free *Trace Center Publications and Media Catalog*. They also maintain a co-op electronic library on disability.

Their most important product is the *Co-Net* CD-ROM. 20,000 listings for co-op directories, publications, media, and materials. Plus a text library. A single CD is $27.

This appears to be *the* single most important disability resource.

Apple Computer

Just about all of the major personal computer manufacturers have strong support for the disabled in one form or another. But *Apple Computer* seems to be head and shoulders above the rest. They pride themselves in having created the industry's first disability group back in 1985.

Start off with their free *Worldwide Disability Solutions*. Their info packet has reprints and a MDR 4.0 disk.

This disk is mainly two files. The first is a Hypercard tour of dozens of third party keyboards, displays, and alternate input devices.

The second file whips on by as you exit. And holds a dozen of the most important field resources.

At one time, Apple did publish a more extensive resource directory. A dated copy of this is in HACK10.PDF on PSRT. Some of the info here may no longer be current, though.

N.I.C.H.C.Y.

The *National Information Center for Children and Youth with Disabilities*. They offer dozens of free booklets to parents, educators, and caregivers.

You can contact them for a free list.

T.A.S.K.

Otherwise the *Team of Advocates for Special Kids* is the parent organization serving all ages and disabilities. They do a newsletter and run a dozen title bookstore. They also distribute a free *Parent Information Packet*.

Some Magazines

Closing the Gap is a bimonthly mag on the use of microcomputer related technology by the disabled. They also put on international conferences that include hands-on workshops. Their next show is October 19-21, 1995 at the Minneapolis Radisson South Hotel.

The *Disability Rag* is one well done in-your-face alternate tabloid. It tells it like it is. Bimonthly. It includes an outspoken *Advocado Press* book and pamphlet service. I particularly like their "This jerk violates accessible parking spaces" stickers.

Educom Review is a slick bimonthly mag about learning, communications, and information technology. Educom is a nonprofit consortium of colleges, universities, and corporations.

The *Exceptional Parent* is a thick and slick monthly magazine for families and professionals. On parenting the disabled child or young adult.

Careers & the Disabled touts itself as the career magazine for people with disabilities. Has a Braille centerfold. Mostly "feel good" stories by Fortune 500 firms congratulating each other.

National Directories

Grey House Publishing has a pair of humongous references available. The first is the *National Housing Directory For People With Disabilities*. The second is the *Directory of Nursing Facilities for Younger Adults with Chronic Physical Disabilities*. Fairly pricey.

These are a mostly for the library or medical reference shelves.

On Line Help

As with any field today, the latest, fastest, and finest info comes down online. This should be your first and foremost place to search for help on just about anything.

All of the major online services do offer a disability forum.

GEnie has a fine *ABLE RoundTable*. Including a 1600+ download library.

To reach them, you enter ABLE on any prompt. If you want to talk to a real sysop person, email ABLE.DAVE or ABLE.DEBI instead.

There is one sure fire way to find out everything about anything. If it ever appeared in print, chances are its offered through the *Dialog Information Service*. Available direct, through your local libary, or conveniently on line at *GEnie*. Of the hundreds of Dialog data bases available, you might start with their MEDLINE service.

Yeah, Dialog is a premium service. Until you include that good old "Uh, compared to what?" factor.

Your real biggie, of course, is that Internet. There's lots of online and CD search services available these days. It gets hard to keep current on even the searchers, let alone the sites.

But, for readers not quite Internet literate, there's a printed alternative. I just got a copy of the brand new *Gale Guide to Internet Data Bases*. With only 8000 files at 2000 sites described, this one is barely off to a good start. But I have found it extremely useful...

handicap.afd.olivetti.com does provide more than 800 files on handicapped life. It is run by Rice University.

trace16.waisman.wisc.edu holds their *Co-Net* text library. This is a co-op network of information providers in the areas of assistive technology. Also files on info system and computer accessibility.

sjuvm.stjohns.edu is that EASI database, short for *Equal Access to Software and Information*. Publications, workshops, laws, and grant sources.

val-dor.cc.buffalo.edu is the location for the *HEATH Resource Center* on higher ed for individuals with disabilities.

ericir.syr.edu is a librarian data base. It includes disability coverage.

www.law.cornell.edu is a repository of US Law. Has documents and comments. One source for the ADA regs.

The *GEnie* ABLE library file #1604 lists additional Internet resources.

Also Rans

There are great heaping bunches of support groups, mags, and products available. Besides an online search, two great ways to pick these up are with *Ulrich's Periodicals Dictionary* or the *Encyclopedia of Associations*. Found on the reference shelf at your local library. Or via *Dialog* on *GEnie*.

Here is my random selection in no particular order...

New Mobility is the slick bimonthly magazine that covers wheelchairs and accessories. $18 per year. These folks also have a mail bookstore.

Recreation Access in the 90's gets published by that *National Recreation and Park Association*.

Palaestra is a quarterly magazine. It serves as a forum for sport, physical education, and recreation.

The *MATP Center* is part of Boston's children's hospital. They are basically

new from
DON LANCASTER

ACTIVE FILTER COOKBOOK
The sixteenth (!) printing of Don's bible on analog op-amp lowpass, bandpass, and highpass active filters. De-mystified instant designs. **$28.50**

CMOS AND TTL COOKBOOKS
Millions of copies in print worldwide. **THE** two books for digital integrated circuit fundamentals. About as hands-on as you can get. **$28.50** each.

INCREDIBLE SECRET MONEY MACHINE II
Updated 2nd edition of Don's classic on setting up your own technical or craft venture. **$18.50**

LANCASTER CLASSICS LIBRARY
Don's best early stuff at a bargain price. Includes the CMOS Cookbook, The TTL Cookbook, Active Filter Cookbook, PostScript video, Case Against Patents, Incredible Secret Money Machine II, and Hardware Hacker II reprints. **$119.50**

LOTS OF OTHER GOODIES

Ask the Guru I or II or III	$24.50
Hardware Hacker II, III or IV	$24.50
Micro Cookbook I	$19.50
PostScript Beginner Stuff	$29.50
PostScript Show and Tell	$29.50
Intro to PostScript Video	$29.50
PostScript Reference II	$32.50
PostScript Tutorial/Cookbook	$19.50
PostScript by Example	$32.50
Understanding PS Programming	$29.50
PostScript: A Visual Approach	$22.50
PostScript Program Design	$24.50
Thinking in PostScript	$22.50
LaserWriter Reference	$19.50
Type 1 Font Format	$16.50
Acrobat Reference	$24.50
Whole works (all PostScript)	$380.00
PostScript Insider Secrets	**FREE**
Hacking Insider Secrets	**FREE**

POSTSCRIPT SECRETS
A Book/Disk combination crammed full of free fonts, insider resources, utilities, publications, workarounds, fontgrabbing, more. For most any PostScript printer. Mac or PC format. **$29.50**

BOOK-ON-DEMAND PUB KIT
Ongoing details on Book-on-demand publishing, a new method of producing books only when and as ordered. Reprints, sources, samples. **$39.50**

THE CASE AGAINST PATENTS
For most individuals, patents are virtually certain to result in a net loss of sanity, energy, time, and money. This two volume set shows you tested and proven real-world alternatives. **28.50**

BLATANT OPPORTUNIST I
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RESOURCE BIN I
A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. **$24.50**

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FREE VOICE HELPLINE VISA/MC

SYNERGETICS
Box 809-NV
Thatcher, AZ 85552
(520) 428-4073

Write in 146 on Reader Service Card.

DISABILITY AND HANDICAPPED RESOURCES

Accomodating Disabilities
4025 West Peterson Avenue
Chicago IL 60646
(800) TELL CCH

Accreditation Council
100 West Road #406
Towson MD 21204
(410) 583-0060

ACM/SIGCAPH
1515 Broadway
New York NY 10036
(212)626-0500

AFB
15 West 16th Street
New York NY 10011
(212) 620-2000

Apple Computer
One Infinite Loop
Cupertino CA 95014
(800) 776-2333

AOTA
PO Box 31220
Bethesda MD 20824
(301) 652-2682

APH
PO Box 6085
Louisville KY 40206
(800) 223-1839

ASHA
10801 Rockville Pike
Rockville MD 20852
(301) 897-5700

Arizona Talking Books
1030 North 32nd Street
Phoneix AZ 85008
(800) 255-5578

Careers & the disABLED
150 Motor Parkway #420
Hauppauge NY 11788
(516) 273-0066

CdLS Foundation
60 Dyer Avenue
Collinsville CT 06022
(800) 223-8355

CEC
1920 Association Drive
Reston VA 22091
(800) 845-6232

Centerlines
PO Box 31345
Raleigh NC 27622
(919) 828-1218

Closing the Gap
PO Box 68
Henderson MN 56044
(612) 248-3294

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

Disability Bookshop
PO Box 129
Vancouver WA 98666
(800) 637-2256

Disabilities Digest
522 Cinti-Batavia Park
Cincinnati OH 45244
(513) 528-0404

Disability Issues Newsletter
300 Longwood Avenue
Boston MA 02115
(800) 848-8867

Disability Policy Journal
346 North West Avenue
Fayetteville AR 72701
(501) 575-3656

Disability Rag
PO Box 145
Louisville KY 40201
(502) 459-5343

Educom Review
1112 16th Street NW #600
Washington DC 20036
(280) 872-4200

Encyclopedia Associations
835 Penobscot Building
Detroit MI 48226
(313) 961-2242

Exceptional Parent
209 Harvard Street #303
Brookline MA 02146
(617) 730-5800

Gale Research
835 Penobscot Blvd
Detroit MI 48226
(313) 961-2242

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

Grey House Publishing
Pocket Knife Square
Lakeville CT 06039
(800) 526-2139

Issues in Law & Medicine
PO Box 1586
Terre Haute IN 47808
(812) 232-0103

Mobility International USA
PO Box 10767
Eugene OR 97440
(503) 343-1284

Natl Recreation/Park Assn
2775 S Quincy Street Ste 300
Arlington VA 22206
(703) 820-4940

New Mobility
PO Box 8987
Malibu CA 90265
(800) 543-4116

NICHCY
PO Box 1492
Washington DC 20013
(800) 695-0285

PALAESTRA
PO Box 508
Macomb IL 61455
(309) 833-1092

Spinal Network
23815 Stuart Ranch Road
Malibu CA 90265
(800) 543-4116

TASK
100 West Cerritos Avenue
Anaheim CA 92805
(714) 533-TASK

Trace Center Publications
S-151 Waisman Cen UWI
Madison WI 53705
(608) 263-5408

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

a clearing house and info center. Who publish a *Disability Issues* newsletter. Their BBS is (800) 950-6287. They have free brochures. Also available in large print, Braille, tape, disk, or Spanish.

Funny, I never thought of Spanish as a disability. Oh well.

The *Disabilities Digest* is a smaller, half-size bimonthly pub. Sorta in the same tone as *Prevention*.

The *ACM*, otherwise known as that *Association for Computer Machinery* has special interest groups on pretty near everything. Their SIGGRAPH graphics stuff is probably the one you are most familiar with. They also publish the SIGCAPH newsletter. On computers and the physically handicapped. They also put on conferences.

An *Accreditation Council on Services for People with Disabilities* appears to be a group of, by, and for institutional bureaucrats. Their newsletter is called *Update on Quality*.

Mobility International is mostly on disabled travel tips. Their newsletter is called *Over the Rainbow*. They've got videos on leadership and homestay.

The *American Federation for the Blind* publishes a quarterly tabloid known as, of all things, the *AFB News*.

Physical Disabilities is the newsletter by that *American Occupational Therapy Association*. Quite technical. Mostly by and for medical types.

Asha is the bimonthly mag from the *American Speech-Language-Hearing Asn*. It is mostly for speech therapists.

The *Council for Exceptional Children* appears to cater to special ed teachers and administrators. Covered interests here do include special ed, behavioral disorders, research, early childhood, education, comm disorders, learning disabilities, and teacher ed.

I'd guess that just about every state has some blind assistance program. In Arizona, one resource is the *Arizona State Braille and Talking Book Library*. I'm certain there's 49 more where this one came from.

Issues in Law & Medicine is a unique scholarly quarterly. Published by that *National Legal Center for the Medically Dependent & Disabled*.

Another heavy pub is the *Journal of Disability Policy Studies*. Published by the University of Arkansas.

Centerlines is the publication of the *Cued Speech* center. This stuff used to be called *sign language*.

American Printing House for the Blind is apparently the leading publisher of Braille and large print books.

The *Spinal Network* offers their *Total Wheelchair Book* for $38. This is mainly support for paralysis victims.

Accomodating Disabilities Decisions is a book by and for lawyers from *CCH*. On prosecuting disability cases. They also publish a monthly *Accomodating Disabilities Management Guide*.

Last, and possibly least, the *Cornelia de Lange Syndrome Foundation* appears to be the ninth alternate runner up in the *Reader's Digest* obscure disease of the month sweeps. Their newsletter is called *Reaching Out*.

This Month's Contest

Our resource topic this month is a little off the beaten track for me. But it was obviously needed for a "complete set" of whatever it is we're up to here.

Let me know if you find out.

So, for this month's contest, please tell me about anything major that I might have missed along the way of handicapped or disabled resources.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For modem access: (800) 638-8369. When prompted, enter JOINGENIE. When asked for an offer code, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM

Don Lancaster's

RESOURCE BIN

number forty-five

Mightily manic multimedia magazine madness.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle one super special signup deal for you *Resource Bin* readers. Ten free hours.

GEnie now offers far lower daytime rates, a direct Internet access, plus a Windows graphics interface, so it's an even better deal than ever.

See the trailer blurb for details.

Multimedia Resources

This month, I thought we'd review a few of those multimedia resources. I won't define multimedia for you. Just as with pornography, you will know it when you see it. The really amazing thing is that there seem to be around 35 different multimedia magazines for *each* person in the field.

The advertisers haven't picked up on CPM meaning "cost per *milli*reader, rather than "cost per thousand".

At any rate, I thought I'd tell you all my favoritie multimedia resources, along with several others that I do not particularly care for.

Before we do, I thought I would go over my two key tools for finding the best magazines and trade journals in any field. These are…

Factsheet Five and Ulrichs

Factsheet Five covers the 'zines and newsletters. Plus topics guaranteed to offend just about everybody. But they are *the* low end resource for labor of love publications. Super high energy stuff from them that's doin'.

At the other extreme is the rather old line *Ulrichs Periodicals Dictionary*. Five volumes located on the reference shelf at your local library. Or online at *Dialog* or *GEnie*. Holds the top 240,000 magazines and newspapers with full descriptions. Also in CD ROM.

Another favorite "where to go and get stuff" mag is *Whole Earth Review*. "Access to tools" is their motto.

U&lc

Your most bizarre multimedia pub anytime ever is *U&lc*. Short for *Upper and lower case*. And, at least to me, is by far the very finest of all.

This is really a house organ for *ITC*, otherwise known as that *International Typography Corporation*. Their creative design is outstanding.

Focus is on type and typography. They are most definitely moving into new online and interactive topics.

Another trade journal is *Electronic Publishing*. An oversized ad tabloid on the latest and finest in fonts, printers, and laser typesetters.

NEXT MONTH: Don looks at resources and opportunites for high power electronics.

Wired

Calling themselves the mouthpiece of the digital generation, this is sort of your Playboy for the nineties. Tightly targeting everything in cyberspace. Included are great interviews, useful news, and outrageous articles.

But far too brash for some tastes.

One competitor to Wired is *Morph's Outpost*. In a large and well-written tabloid format. Haven't seen this one lately. Hope it is still in print.

Computer Graphics

The best multimedia show is the big annual *SIGGRAPH* gathering. They are a special interest group of *ACM*, the *Association for Computer Machinery*.

These folks have a superb quarterly *Computer Graphics* journal. One which is very big on underlying math theory and fundamental algorithms. Usually their fall issue #3 includes their full SIGGRAPH Proceedings.

One competing trade journal is that *CGW*. As in *Computer Graphics World*. Who also have Siggraph reviews. And do cover such topics as animation and visualization software.

Video Toaster User

A fine example of a magazine with genuinely useful technical content. At one time, the *NewTek* Toaster had low cost video editing to itself. Between that Amiga debacle and PC and Mac coming on strong, they've got lots of new competition.

Newtek is fighting back with the latest in *nonlinear editing* techniques. Particularly their *Video Flyer* and their *Video Toaster for Windows* products. And their greatly improved *LightWave* animation rendering software.

A nonlinear editing eliminates any need for videotape. Your entire ad or presentation or movie or whatever is stored on hard disks. Giving instant access to any part in any order. And forever eliminating crude "cuts only" or "A/B roll" editing.

This is still one of my favorite pubs. And a good example of how readable and concise tech info should be *the* foremost goal of *any* magazine.

NewTek has free toaster videos.

New Media

One thick and competent monthly mag. Although a tad heavy on glitzy ads. Lots of reviews and product info. Topics include JPEG, MPEG, high end

Mac reviews, kiddy titles, more. Plus Scott Kim's end-of-mag puzzles.

Multimedia Producer

I've only seen one copy of this one. "For the creators and developers of interactive multimedia". It's intended for CD ROM developers.

Computer Video

This is the new kid on the block. An oversize bimonthly tabloid providing outstanding technical content. Highly readable. Free to qualified readers.

These folks also offer *Radio World* and *TV Technology*. Two quality mags for tv and radio production.

Bove and Rhodes

A longtime alternative multimedia info resource, Tony Bove and Cheryl Rhodes offer a number of publications and services. Their *Bove and Rhodes Insider's Report* is one example. You contact them directly for more info.

Movie Stuff

The best traditional trade magazine here appears to be *Film & Video*. And your finest special effects magazine is now *Cinefex*. I particularly like all of their insider film secrets.

I have posted other special effects resources in HACK72.PDF.

Printshop Magazines

By far the most useful trade journal is *Quick Printing*. Especially for their *Helene's Hotline* product location data base. A competitor is *Instant and Small Commercial Printer*. Two others are the *Printer's Hotline* shopper and *Printer's Shareware* sofware store.

For T-Shirt stuff, check *Impressions*, *Printwear*, or *Screen Printing*. More on printshop stuff in HACK27.PDF.

Publish

Well, because its there, I guess. This is a rather high circulation ad-driven magazine centering on page layout and such. After talking to some other graphic artists, we've all reached the same conclusion: *Publish* always gets the "before" and "after" shots *mixed up* on their page remakes! Usually, they trash a clean layout by ultra glitzing it. With results only an ad director's mother could love.

Online Resources

There's great heaping bunches of multimedia stuff online. All of those commercial services have at least one offering. On *GEnie*, my PSRT covers a few multimedia topics. Especially on compression and digital halftones. Three more extensive *GEnie* resources are *Desktop Publishing* over at DTP and *Computer Game Design* at CGD. Plus the computer musicians at MIDI.

But the best *GEnie* resource of all is MULTIMEDIA$. Having a *RoundTable* and a *Product Catalog*. They also do publish a *Cybernetic Report*.

The usual **http://www.yahoo.com** is a good search engine for locating nearly any Internet subject. There are plenty of others. Including some brand new CD ROM based services way too new for review. The printed edition of the *Gale Guide to Internet Data Bases* seems curiously silent on multimedia as a subject. But is otherwise handy.

There are lots of online newsstands. Most of these range from dismal on down to mesmerizingly awful.

Some of the better ones are *VIBE Online*, *BUZZnet*, and *Hot Wired*.

The problem with all of these is that the HTML web markup language gets *totally useless* whenever it comes to attractively presenting info. Waiting in the wings is the infinitely superior Adobe *Acrobat*. Which *fully* preserves all fonts, photos, and graphics.

In tightly compacted files.

I've got scads of Acrobat support up on *GEnie* PSRT. Including all the key Adobe tech notes and hundreds of files. Start with ACROCAT.PDF.

Imagining Inane Imaging Issues

Does it really matter that there are *several dozen* multimedia magazines having virtually the same name? Not really, because most of them seem to me to be glitzy, highly ad-driven rags totally devoid of any genuinely useful content. Most of these are free and worth every cent of it.

One exception is *Advanced Imaging*. This one is mostly a trade journal for the high end scientific needs. They are particularly big on solid state video cameras and machine vision. *SPIE* is a second tech info source here.

Some "also rans" here are *Imaging Magazine* on "Document Solutions for Business"; a *Photo Electronic Imaging* "Integrating Photography, Electronic Imaging, & Graphics"; *Copy Imaging & Repoduction* on copiers.

Or *Digital Imaging* "A magazine for Graphics Service Users"; or *Imaging Business*, "The Voice of the Document Imaging Channel".

Three more equally exciting mags are *Color Publishing*, *PC Graphics and*

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ACTIVE FILTER COOKBOOK
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PostScript Beginner Stuff	$29.50
PostScript Show and Tell	$29.50
Intro to PostScript Video	$29.50
PostScript Reference II	$32.50
PostScript Tutorial/Cookbook	$19.50
PostScript by Example	$32.50
Understanding PS Programming	$29.50
PostScript: A Visual Approach	$22.50
PostScript Program Design	$24.50
Thinking in PostScript	$22.50
LaserWriter Reference	$19.50
Type 1 Font Format	$16.50
Acrobat Reference	$24.50
Whole works (all PostScript)	$380.00
PostScript Insider Secrets	**FREE**
Hacking Insider Secrets	**FREE**

POSTSCRIPT SECRETS
A Book/Disk combination crammed full of free fonts, insider resources, utilities, publications, workarounds, fontgrabbing, more. For most any PostScript printer. Mac or PC format. **$29.50**

BOOK-ON-DEMAND PUB KIT
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Box 809-NV
Thatcher, AZ 85552
(520) 428-4073

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MULTIMEDIA RESOURCES

ACM/Computer Graphics
1515 Broadway
New York NY 10036
(212)626-0500

Adobe Acrobat System
1585 Charleston Rd
Mountain View CA 94039
(800) 833-6687

Advanced Imaging
445 Broad Hollow Rd #21
Melville NY 11747
(516) 845-2700

AV Video
701 Westchester Avenue
White Plains NY 10604
(800) 800-5474

Bove & Rhodes Reports
Box 1289
Gualala CA 95444
(707) 884-4413

CD-ROM Today
23-00 Route 208
FairLawn NJ 07410
(201) 703-9500

Cinefex
Box 20027
Riverside CA 92516
(909) 781-1917

Color Publishing
1 Technology Pk Dr
Westford MA 01885
(508) 392-2166

Computer Artist
1 Technology Park Dr.
Westford, MA 0185
(508) 692-7000

Computer Graphics World
1 Technology Pk Dr
Westford MA 01886
(508) 692-0700

Computer Video
5827 Columbia Pike 3rd Fl
Falls Church VA 22041
(703) 998-7600

Copy Imaging & Repro
1680 SW Bayshore Blvd
Port St Lucie FL 34984
(407) 879-6666

Digital Imaging
21150 Hawthorne Blvd #104
Torrance CA 90503
(310) 371-5787

Electronic Entertainment
951 Mariner's Isle Blvd #700
San Mateo CA 94404
(415) 349-4300

Electronic Publishing
401 N Broad St
Philadelphia PA 19108
(215) 338-5300

Factsheet Five
R Seth Friedman
PO Box 170099
San Francisco CA 94117

Film & Video
8455 Beverly Blvd #508
Los Angeles CA 90048
(213) 653-8053

Gale Research
835 Penobscot Blvd
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401 N Washington St
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New York NY 10010
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Impressions
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(212) 669-1300

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(301) 587-8202

Information Display
201 Varick Street
New York NY 10014
(212) 620-3371

Instant & SC Printer
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Interactive Video News
Box 61130
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KIPI Bookshelf
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Multimedia Law Report
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New Media
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San Mateo CA 94404
(415) 573-5170

NewTek
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NEXT Generation
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Burlingame CA 94010
(415) 696-1661

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Atlanta GA 30303
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Printer's Shareware
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Dallas TX 75209
(214) 350-1902

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Broomfield CO 80020
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San Francisco CA 94107
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Cincinatti OH 45202
(513) 421-2050

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Santa Fe NM 87502
(505) 982-3532

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San Francisco CA 94107
(415) 905-2200

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(212) 371-0699

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(212) 947-6500

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Sunnyvale CA 94086
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PO Box 4591
Chico CA 95927
(916) 891-8410

VR World
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Westport CT 06880
(203) 226-6967

VSM
825 Seventh Avenue
New York NY 10019
(212) 887-8400

Whole Earth Review
27 Gate Five Rd
Sausalito CA 94965
(415) 332-1716

Wired
544 2nd St 3rd Fl
San Francisco CA 94107
(415) 904-0664

Video and *AV Video* "Production and Presentation Technology".

The Dregs

One of the immutable physical laws here at *Synergetics* is that something has to be at the bottom of the pile. So, here is my collection of oddball and interesting stuff which is "not quite" centered on multimedia:

3-D Artist is a graphic design mag out of Santa Fe. Their competitor is apparently the *3-D Design* out of San Francisco. *VSM* is on Video Software Management. Otherwise known as running a video rental store. Lots of ads for cheap vids. Especially if you don't care about the title.

VR World is a virtual reality mag, while *Response TV* will let you hit it big with late night tv advetorials.

Interactive Video News is a pricey high end newsletter. On multimedia, pay-per-view, shopping, new demand video and such. *Information Display* is a rather dull and dreary trade journal from the *Society for Information Display* folks. Mostly on liquid crystal display and related wannabes.

Electronic Entertainment, *CD ROM*, and *NEXT Generation* are mostly for end users. So are both *Videomaker* and *Video Pro*. *Technique* is a "how to guide to successful communications". What *Publish* should have been. *Inform* is an odd publication by the *Association for Information and Image Management*. And *Multimedia Technology Licensing Law Report* is a pricey newsletter.

Two multimedia book sources are *KIPI Bookshelf* and *MIX Bookshelf*.

Additional multimedia resources do appear in HACK71.PDF.

This Month's Contest

For our contest this month, just tell me about any multimedia resource I don't already know about.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 33 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For modem access: (800) 638-8369. When prompted, enter JOINGENIE. When asked for an offer code, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM

Don Lancaster's

RESOURCE BIN

number forty-six

New opportunities in power electronics.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GEnie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle one super special signup deal for you *Resource Bin* readers. Ten free hours.

GEnie now offers far lower daytime rates, a direct Internet access, plus a Windows graphics interface, so it's an even better deal than ever.

See the trailer blurb for details.

Power Electronics

This month, I thought we'd take a look at a few new power electronics resources. All of a sudden, this rather staid and arcane field is exploding. Mostly thanks to several brand new tools, devices, and techniques. Many of which are easily explored by you individuals and tech startups.

So, there are now lots of brand new opportunities here.

Let us first look at a few exciting new developments you could directly profit from. Then we'll round out our survey with a look at those older and more traditional power resources.

Magic Sinewaves

Electric cars, off-grid solar panels, induction motor speed controls, and home energy efficiency improvers all share a common problem: Cheaply, simply, and efficiently generate low distortion power sinewaves. Waves of carefully controlled amplitude and of a precisely controlled frequency.

Usually, you will start off with a four-switch beastie called an *H-Bridge Drive*. The object of the game is to flip your four switches just so, creating a sinewave output. For best efficiency, you'll want to flip the switches as *few* times as possible per cycle. And you'd also like to consistently flip only *half* of the switches at once. For a further efficiency doubling.

There is a brand new game in town I like to call *Magic Sinewaves*. Magic Sinewaves are very long sequences of carefully selected repeating ones and zeros. They easily give you bunches of high quality sinewaves of most any amplitude and frequency.

Magic sinewaves whose harmonics can be forced to *zero*. Or else held to amazingly low values.

To use your magic sinewave, you simply stash a listing of them in a dollar PIC or another cheap micro. For level #85, you grab sequence #85 and shove it out one or more ports. Your delay between bits sets the frequency.

NEXT MONTH: Don looks at several oddball and unusual phone and comm resources.

Single, two, or three phase. Per your choice. It's all that easy.

Compared to the industry standard PWM (pulse width modulation) way of doing things, the magic sinewaves offer far less high frequency losses. Ridiculously so. As much as a 25:1 or higher improvement!

Heatsinks can be much smaller and all your power drivers much cheaper. Integration, offsets, nonlinearities, and noise totally vanish.

Magic sinewaves seem brand new because they've traditionally been so excruciatingly hard to find. At least before some brand new tools became available. A typical magic sinewave is 384 bits long. There are more magic sinewaves than there are atoms in the solar system. So, finding them used to be worse than finding a needle in a multi-dimensional universe chock full of humongous haystacks.

A ferinstance: Hex $1006 070E 1F87 FE3F FF7F FFFF is one quadrant of a 384-bit magic sinewave. This outputs 97.8% of your supply voltage. With a reasonable filter, your *total* harmonic distortion 3-17 is an astounding 0.031 percent! Even when *totally unfiltered*, the same sequence offers a negligible third harmonic of only 0.0065% and a fifth way on down at 0.0261%.

I'll call this one the Mother of all magic sinewaves. Well, at least this week. Better ones are arriving daily. The brothers and sisters in this series will give you 128 or more uniformly spaced amplitudes from zero to your full supply voltage.

I will be happy to mail you a free tutorial on magic sinewaves.

My *GEnie* PSRT is the center of the universe for magic sinewave concept development. By myself, from math genius Jim Fitzsimons, and by other leading edge researchers. Start with that MAGSINT.PDF tutorial. Then go on to the dozens of other files. Just search under "magic".

Custom consulting, a co-developer program, sine analysis & synthesis, source code, and ready-to-run chips are all available. Call or write me for more info on this multi-million dollar opportunity. Or use my email address from the end blurb.

Car Alternator Steppers

The price of power stepper motors is dropping. There certainly are lots of bargains right here in *Nuts & Volts*. But scant few people realize that a car alternator can be converted into a fair to middlin' power stepper at very low cost. And local availability.

That very same alternator can also become a switched reluctance motor or a servo. Generally what you do is dc power the rotor, converting it into a "permanent" magnet. You will then sequence your stator coils to create a stepper. Or apply suitable sinewaves for a switched reluctance drive.

Uh, a "three phase" stepper motor may seem a little weird, compared to those usual 2-phase and 4-phase ones.

But it works like a champ.

You will get best results by using a current drive scheme. Details on this in most stepper drive ap notes.

John Rees markets an outstanding self-produced video on converting car alternators into power steppers. He also takes you step-by-step through building a humongous programmable sign router using car alternators for three axis control.

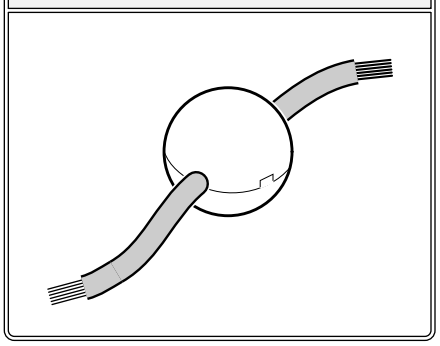
Additional details on car alternator steppers are shown in NUTS34.PDF, HACK47.PDF, and EMERGOP3.PDF.

Isopod Current Monitors

Home energy efficiency starts with knowing exactly how much ac power gets used for what. But measuring the main and branch ac currents can end up a horrible mess. Involving safety regs, electricians, and rewiring.

Here's a little gadget that I've got an in-house research project going on. I like to call it the…

ISOPOD ENERGY REPORTER



The isopod snaps onto one of your your incoming power lines right at your weatherhead. This is basically a self-powered current transformer and a short range transmitter.

The simplest version transmits a digital signal burst every now and then. One that identifies the Isopod, your current zero crossing, and how much current is being consumed.

A nearby reciever gathers in the digital current burst and routes it to a microcontroller, modem, or personal computer. A local line reference gives the voltage. By comparing the phase angle of your current zero crossings against the voltage, both the real and reactive power can be found.

Other isopods can be snapped onto branch circuits or even made part of individual appliances. One place they should be super handy is for fixing air conditioning intermittents. A fancier unit could include a reciever so they speak only when spoken to.

For full home energy management, dozens of Isopods could be spotted in appropriate places. Leading to greatly reduced home electric bills.

More on Isopods in NUTS34.PDF, HACK47.PDF, and EMERGOP3.PDF on *GEnie* PSRT. Hard copy reprints and custom consulting is also available.

PostScript Robotics

I sure get an amazing number of helpline callers wanting to build their own two-axis or three-axis robotic systems. For everything from printed circuit drills to milling machines, to embroidery setups, animation stages, and silk screen cutters.

Regardless of what these do, I like to call them *flutterwumpers*. Well, a flutterwumper moves something that chomps or spits against a piece being worked. Under computer control.

As I may have mentioned once or thrice before, there is this general purpose computer language known as *PostScript*. PostScript is *absolutely ideal* for *all* flutterwumpers. Because of the ease with which it can handle graceful curves and typography.

Usually, you'll apply a two-step process. You use a PostScript printer or GhostScript shareware on a PC to generate your artwork and curves or such. Bring the full power of all the world's fonts, Illustrator, Acrobat, Photoshop, scads of CD-ROM clip art, and lots more to the table.

Your printer or your program then generates an output text file in a very simple control language. One which ridiculously minimizes all the smarts needed by your actual flutterwumper. While you could use *Gerber* format or the HPGL graphics language for the output, all you'll often really need is simple serial commands. Such as "U" for up and "D" for down. Or "N" for North and "S" for South.

All of which lets you reduce your flutterwumper intelligence down to a one dollar microcontroller. That new *Basic Stamp* from *Parallax* is ideal for this sort of thing. For higher speed and performance, you can step up to those *Scott Edwards PIC Tools*. Or use

new from
DON LANCASTER

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Miami Lakes FL 33014
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any of the fine applications info from *MicroChip Technology*.

Fundamentals of PostScript appear in STARTUP.PDF and SPEEDUP.PDF. For more info on flutterwumpers, see FLUTWUMP.PDF, FLUTOOLS.PDF, or else NUTS19.PDF.

New Integrated Circuits

Prices of power semiconductors are dropping dramatically. We are also seeing the low level circuits combined on-chip with the power output stages for further economics.

Newer power MOS transistors are now cheap to buy and easy to use. They are vastly easier to drive than an older bipolars or Darlington. Besides being less likely to blow up.

One neat trick with some power MOSFETs: It's a simple matter to put 10,000 identical MOS transistors on the same chip. You use 9999 of these for your main load circuit. And then take the last one and sense your current through it. This current will be 100 microamps *per amp* of load current. All of which can give you a "lossless" current sensor. One which requires nothing in series with the bulk of the main load current.

National Semiconductor has free samples of their LMD18245 H-Bridge Driver. Besides their lossless current sensing, this includes a current drive (for higher speeds and more power), and the ability to power down to one of sixteen levels. Forward or reverse. Easily driven from any micro.

Full details on this low cost power stepper driver in MUSE93.PDF.

Texas Instruments also has several interesting *Power+Arrays* chips. These work well as drivers or predrivers for alternator steppers.

Other places to search for power electronic solutions do include *Maxim*, *Linear Technology*, *Siliconx*, *Motorola*, *Analog Devices*, *Allegro*, *SGS*, *Harris*, and *International Rectifier*.

The really big power semis (such as those used for locomotives) are made by supply houses that keep changing their names. For instance, that old Westinghouse operation is now called *Powerex*. Check out their *Applications and Technical Data Book* on their new *Intellimod* power modules.

Surplus Bargains

I recently discovered *Jim DuBois*, an incredibly great new source for lots of stepper motors, rotary tables, gantrys, drivers, precision stages, and such. Apparently Jim visits the failing New England aerospace firms, scooping up these gems when and as found.

An example: A complete X-Y table including steppers for around $100. A tiny fraction of the initial cost. Jim has a free flyer available on request.

Needless to say, you should also be on a first paw basis with your local junkyard dog. Share a bowl of Purina every now and then. Or maybe even a rawhide chew.

And tune yourself into both the local and statewide auction scene.

My favorite older surplus source for big mutha iron is *C&H Sales*. AC and DC motors, steppers, hydraulics, pneumatics, and the bits and pieces needed to put it all together. Most at very good prices.

Other sources for the heavy stuff do include *Burden's Surplus Center* and *Northern Hydraulics*.

Two other lighter favorites are *Fair Radio Sales* for military electronics, and *American Science & Surplus* for lots of oddball smaller items.

Rounding out the surplus scene is *Edmund Scientific*, *Herbach&Rademan*, *Surplus Traders*, *Radio Research*, and the rather pricey *AST Servo Sales*.

Much more on surplus sources in NUTS06.PDF on *GEnie* PSRT..

Grainger and Galco

The most obvious source for nearly anything electrical is *W.W. Grainger*. Who have outlets in most larger cities. Grainger is especially big on electric motors and pumps. Plus a stunning variety of light bulbs and fixtures. A large catalog is available.

For more info on lamp and lighting resources, see MUSE95.PDF.

The leading distributor of old line power electronics components is the little known supplier by the name of *Galco*. They do publish a free *Galco Gazette*, besides offering a fat catalog to potential volume customers.

Two other firms anyone in power electronics has to know about: *Small Parts* has everything your hardware store has never heard of. They sell in small quantities at reasonable prices. They are the greatest robotics source anytime ever. They'll also custom cut metal and plastics for you.

Good old *McMaster-Carr* is sort of a universal industrial hardware source. Their distinctive yellow catalogs can be found industry wide.

PCIM

The leading power electronics trade journal seems to be *PCIM*, formerly *Power Control and Intelligent Motion*. It is free to qualified subscribers. Their competitors are *Motion* and *Motion Control*. Also try *MotorTechniques* and *PowerTechniques*. But these two may have recently folded.

Meanwhile, Penton has just come up with the brand new and somewhat misnamed *Power Transmission Design* magazine. This one also centers itself on motion control subjects. Your two finest classic mechanical design trade journals, of course, remain *Machine Design* and *Design News*.

The IEEE has scads of publications that at least touch upon power. Their *IEEE Transactions on Power Electronics* is the biggie. But other Transactions to check are Automatic Control, Energy Conversion, the Industrial Electronics, Power Devices, Industry Aps, Robots & Automation, and Vehicular Tech.

Two other organizations to check are the *Electric Power Research Institute* and *SAE*. The car folks.

There's lots of other trade journals I have found rather useful for power electronics. *Appliance* and *Appliance Manufacturer*, ferinstance. Or, at the other end of the problem, *Sensors* or *Measurement & Control*.

I didn't get much of a chance to check those power electronics online resources by column deadline time. Mostly because Magic Sinewaves are so obsessive that I've been spending as much as twenty hours a day on them. Just barely squeaking by on column deadlines. But *Gopher* and the usual CD directory search services can lead you to useful sites.

As usual, you can find out anything about anything by using the *Dialog Information Service*. Found on *GEnie*, elsewhere on line, or by way of your local library. Your best info source for insider magazines is *Ulrichs*.

Home Power

Of the hobby or newsstand mags *Home Power* is really coming on strong with homebrew power electronics. Particular for alternate energy, solar and wind power, and especially home built electric cars.

And, of course, you'll start seeing more and more higher power projects right here in our *Nuts & Volts*. Also be sure to check out *Electronics Now* and *Circuit Cellar*.

This Month's Contest

For our contest this month, just tell me about any new or unusual power electronics resource which I do not already know about. Especially tune me into any useful online sites.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all

Let's hear from you. ✦

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Don Lancaster's

RESOURCE BIN

number forty-seven

A look at telecommunications resources.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

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I did manage to wrangle one super special signup deal for you *Resource Bin* readers. Ten free hours.

GEnie now offers far lower daytime rates, a direct Internet access, plus a Windows graphics interface, so it's an even better deal than ever.

See the trailer blurb for details.

Telephone Electronics

This month, I thought we'd take a look at some lesser known resources involving telephone comm.

Happily, the statute of limitations is long expired on the phone phreaking secrets I am about to reveal here. In print for the first time ever.

Back before they had phone freaks, they had me. In those times, things sure were a lot simpler. To get a free local phone call, you simply shoved a pin through the handset cable on a pay phone. You then grounded it to the coin slot. Briefly

A free long distance call was a tad trickier. The worst part was that you had to borrow enough change to start your actual call. One minute into your conversation, you inserted a special "W" shaped coat hanger into the coin return and flipped the mechanism.

Free phone calls were essential to a starving college student in the early sixties. Especially since they kept all the females locked up 40 miles away at Cedar Chest College.

Winos would also stuff paper on up the coin returns of pay phones at bus stations and such. People in a hurry usually would not complain. A route of several dozen phones sometimes yielded a marginal income.

The more astute of you might note that pay phones these days seem to include an armored cable and a coin return hopper or reverse flipper.

Ever wonder why?

Some Basics

Your phone line consists of a +48 volt dc source having an impedance of roughly 600 Ohms. The green wire is normally positive and called the *tip*. The red wire is normally negative and called the *ring*. The names date from when real phone jacks got used.

In its *on hook* state, *only* the bell of your telephone gets connected to your line through a dc blocking capacitor. The capacitor value and inductance of a traditional bell winding resonate at a 40 Hertz low audio frequency.

To ring the phone, a very high ac voltage of 100 volts or so is applied at a frequency of 40 Hertz. At one time long ago, different ring frequencies were used to selectively isolate party line phones. In more modern phones, a series resonant circuit extracts the ring information.

NEXT MONTH: Don looks at recent developments in solar power and alternate energy.

Picking the phone up *off hook* loads the line, dropping its dc voltage to eight volts. One way you can tell if a modem or extension phone is active is to simply measure the dc line voltage.

Details in HACK41.PDF

Dialing is done in one of two ways. That *pulse* method used a mechanical dial. It *broke* the line connection equal to the number of counts desired. For a zero, you got *ten* counts.

The *Touch Tone* scheme generates a pair of audio tones using a *two-of-eight* code selected from four *low band* tones and four *high band* tones.

The rest of your phone is mostly a microphone or other voice *transmitter* and a headphone or some other voice *receiver*. These two interact through a nearly balanced *hybrid* transformer.

The main purpose of the hybrid is to allow full duplex conversations. By letting your transmitted audio go out over the phone line and the incoming audio go to the receiver.

A slight unbalance is created in the hybrid to let a little of the transmitted energy appear in the receiver. This is called the *sidetone* and lets you hear yourself. It is just enough to keep you from shouting.

The normal telephone signal levels are somewhere below 0 DBM. Or one milliwatt into 600 Ohms. Equal to an ac voltage under one volt rms.

The only real differences between voice, fax, and modem is that fax and modem send out specific tones used for digital data comm. Unless special steps are taken (involving digitized audio), you can *not* simultaneously send voice and high speed data over the same phone channel.

Current Topics

Some of the phone stuff that seems to interest a lot of people these days: Part 68 interfaces, line recording, ring detection, call progress monitoring, touchtone encoding and/or decoding, PostScript fax, and caller id.

Two sets of highly restrictive FCC rules apply when you connect to the phone line. Part 15, which is plain old "thou shalt not transmit interference". And Part 68, covering the specifics of phone line interconnect.

More Part 68 interface details are in HACK07.PDF and HACK61.PDF.

In general, all you'll really need to meet FCC Part 68 is a transformer and some clipping diodes to restrict max amplitude. But extensive certification testing is involved. Gruesomely so. In particular, the lateral balance spec is a real bear to meet.

Carefully selected capacitors could replace a fancy transformer. But it is extremely tricky to do so.

The FCC regs appear in several blue and white volumes that are part of chapter 47 of the CFR. Or otherwise called the *Code of Federal Regulations*. These are found in any large library that has a government docs section. You can also buy them directly from the *US Government Bookstore*.

Your cost is around $17 per volume. There are five or six volumes needed for the full set of FCC specs.

Because meeting the Part 68 specs are so gruesome, most users will opt for a "pass through" certification.

Where you buy a certified interface and then call it your own. Several *Nuts&Volts* advertisers offer low cost kits here. *Circuitwerkes* is one hobby source. Two commercial sources here include *Cermetek* and *Dallas*.

More on getting your own Part 68 certification appears in the *Compliance Engineering* trade journal. More on FCC specs in HACK45.PDF.

A telephone recorder is basically a simplified Part 68 interface. A typical circuit appeared in HACK07.PDF. And also available in the *Hardware Hacker* reprints. Ring detection is often done by use of a zener-LED-photodetector lashup. Custom ring detector ic's also exist. With *Texas Instruments* being a leading supplier. More details once again in HACK07.PDF.

Call progress detectors get involved if a modem has to determine whether a busy signal arrived or if a call has gone through. *Teltone* is the leading supplier for these low cost chips. A circuit appears in HACK17.PDF.

The touch tones are a two-of-eight selection of a group of low and high audio tones. These could be useful for telephone signalling, for ham repeater control, and some alarm and coding applications.

But their baud rate is horribly low for anything else. These chips come from *Teltone* and similar sources. The *Basic Stamp* from *Parallax* has a totally hassle-free touch tone generator built in to its unique firmware.

PostScript FAX is a new system that completely, totally, and utterly blows away grubby old FAX. This gives you precise *camera-ready* art much faster and cheaper. Even when sent to an ordinary FAX machine, the quality is ridiculously higher. More on this new technology is found in ATN5011.PDF, ATN5128.PDF, ATN5135.PDF, and in FAXPRINT.TXT.

Ah yes, caller id. By far number one in file popularity on PSRT. Start with HACK40.PDF for a tutorial. Next, you search under "caller" for the dozens of additional files and circuits.

Basically, a short data burst is sent between your first and second rings. Even though it is transmitted at 1200 baud, this burst is *not* receivable by an ordinary modem. Because of the odd format and framing used.

Bellcore

The horse's whatever source for all telephone standards is *Bellcore*. Very pricey, but they do have a free catalog on all their specs and guidelines.

Nearly all of the technical details of the phone system are covered.

Other sources for some telephone specs include *The Information Store* and *Global Engineering Documents*.

Telecom Books

The best phone book store I have found so far appears to be *Telecom Books*. They have several free catalogs available. Including one centered on computer telephony. Many hundreds of new titles are available.

Probably the best starter book is *Understanding Telephone Electronics* by Stephen Bigelow. Another one is *Basic Telephone Installation*. This one is in the *TeleTraining Pocket Guides*.

One good third party caller id book is the *Principles of Party Line Station Identification*. Telecom also resells a *Computer Telephony Starter Kit*.

This five book collection includes *Newton's Telecom Dictionary*, *Computer Based Fax Processing*, *PC Telephony*, *Client Server Computer Telephony*, and *Telephony for Computer Professionals*.

By the way, I finally did find out what "client-server" means. The term means the same as "lemon-scented".

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Short Hills NJ 07078
(201) 564-4454

Bellcore
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Morristown NJ 07926
(201) 829-4785

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Cellular Marketing
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Englewood CO 80111
(303) 220-0600

Cermetek
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Circuitwerkes
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Gainesville FL 32607
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Nokomis FL 34275
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Communications Technology
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Englewood CO 80155
(303) 792-0023

CommunicationsWeek
600 Community Dr
Manhasset NY 11030
(516) 562-5000

Compliance Engineering
629 Massachusetts Ave
Boxborough MA 01719
(508) 264-4208

Computer Telephony
12 W 21 St
New York NY 10010
(212) 691-8215

Dallas Semiconductor
4401 Beltwood Pkwy S
Dallas TX 75244
(214) 450-0400

Data Communications
1221 Americas Ave
New York NY 10020
(212) 512-2000

Information Store
500 Sansom St #400
San Francisco CA 94111
(415) 433-5500

Exar Corp
PO Box 49007
San Jose CA 95161
(408) 732-7970

FiberOptic Product News
301 Gibraltar Dr
Morris Plains NJ 07950
(201) 292-5100

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

Global Communications
6300 S Syracuse Way #650
Englewood CO 80111
(303) 220-0600

Global Eng Documents
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Englewood CO 80112
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Nashua NH 03062
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Mitel
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(619) 276-3421

Mobile Radio Technology
9800 Metcalf
Overland Park KS 66212
(913) 341-1300

Motorola
5005 E McDowell Rd
Phoenix AZ 85008
(800) 521-6274

MX-Com Inc
4800 Bethania Station Rd
Winston-Salem NC 27105
(800) 638-5577

Network Computing
600 community Dr
Manhasset NY 11030
(516) 562-5000

Nuts & Volts
430 Princeland Ct
Corona CA 91719
(909) 371-8497

Parallax
3805 Atherton Rd #102
Rocklin CA 95765
(916) 624-8333

Printer's Hot Line
PO Box 1709
Fort Dodge IA 50501
(800) 950-7746

RCR Wireless Comms
1728 Downing St
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(303) 832-6000

SGS-Thomson
1000 E Bell Rd
Phoenix AZ 85022
(602) 867-6259

Sierra Semiconductor
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San Jose CA 95132
(408) 263-9300

Surplus Traders
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Synergetics
Box 809
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(520) 428-4073

Telecom Library
12 West 21st St
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(800) LIBRARY

Telecommunications
610 Washington St
Dedham MA 02026
(617) 326-8222

TeleProfessional
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Waterloo IA 50701
(800) 338-8307

Teltone
22121 20th Ave SE
Bothell WA 98021
(800) 426-3926

Texas Instruments
PO Box 809066
Dallas TX 75380
(800) 336-5236

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

US Government Bookstore
720 N Main St
Pueblo CO 81003
(719) 544-3142

Wireless Design & Dev
301 Gibraltar Dr
Morris Plains NJ 07950
(201) 292-5100

The Mart

This one is by far the best magazine for most telephone bargains. Over 200 pages per month. It's pretty much an "ads-only" tabloid classified shopper. But does have tech tutorials.

Their ads list everything from pay phones to recycled PBX units on up to headsets and handsets. Repairs and site services, too.

Be sure to check out those sister publications of *The Mart* as well. Their *Comp-U-Mart* utterly blows *Computer Shopper* away. And their *Printer's Mart* is right up there with *HorseTrader* and *Printer's Hot Line* for printshop and desktop publishing bargains.

Surplus Traders

A great source for just about any surplus telecomm is Marvin Birnbom at *Surplus Traders*. He maintains hot daily buy-sell FAX sheets.

Telecom Sources

The real phone bargains come from the Far East. *Telecom Sources* is one of a group of fat and slick trade journals distributed by *Asian Sources*. A recent issue focused upon cordless phones, home fax machines, telecom chipsets, private paging systems, and modems. A good mix of tech info is combined with hundreds of ads.

Telecom Sources is intended mainly for the large quantity buyer. But the technical information is useful for just about anybody.

Subscriptions are a tad pricey at $65 per year. But if you can find *any* copy of *any* magazine in the series, there is a mail-in coupon to get a sample of any other mag offered.

The other magazines in the series include *Electronics*, *Timepieces*, *Gifts & Home Products*, *Electronic Components*, *Computer Products*, *Fashion Accessories*, and *Hardwares*. By "Hardwares" they mean things like drill presses.

These magazines are probably *the* best way to find far eastern contacts.

A free finder service is offered.

Other Trade Journals

As with any field, there are zillions of trade journals. All you have to do is pin them down. Most are free. And, for most of the remainder, you can get a freebie copy just by requesting an advertising media kit. While I may have mentioned this a time or three before, *Ulrichs Periodicals Dictionary* is *the* place to go to get a list of all mags everywhere. Either on the reference shelf of your local library, or online through *GEnie*.

By far the most important historical pub, of course, is the old *Bell System Technical Journal*. The bible of phone phreaks everywhere. Those innermost secrets of the phone company all laid bare. This one has apparently ceased publication. But it remains available in larger technical libraries.

I have posted a listing of comm resources as HACK64.PDF.

A few random samples...

Computer Telephony calls itself "The magazine for computer and telephone integration." Sister magazines include *Teleconnect* and *Call Center*. The latter is a support mag for customer service help desks and such.

Lots of publications seem to have "communications" in the title. Some of the more interesting include...

All in Communications
Communications
Communications News
Communications Technology
Communications Week
Data Communications
Global Communications
Telecommunications

Network Computing also has some useful phone stuff in it.

Cellular Business is about marketing and distribution of the cellular phones and services. One of their competitors is *Cellular Marketing*. Pagers and such appear in *Mobile Radio Technology*. An insider trucker mag is *Land Line*.

Fiber optic comm is well covered in both *Fiber Optic System Design* and in *LightWave*. One of the best of the new wireless mags is *Wireless Design and Development*. A second source is *RCR Wireless Communication*.

Last and least, that *TeleProfessional* teaches you how to make obnoxious and annoying phone calls.

When the Chips are Down

The two most interesting telecomm chip houses are *Teltone* and *MX-COM*. Teltone is big on their call progress detectors. Plus touchtone encoders and decoders. MX-COM has all sorts of neat stuff. Including scrambling and privacy circuits. Bunches of mobile comm selective calling. And a brand new caller id chip.

Your best older source for caller id chips is *Sierra Semiconductor*. With *Exar* and *Motorola* being the also rans. *Mitel* has a lot in the way of PBX and crossbar semiconductors.

Uh, for some strange reason *AT&T* seems to want to sell telephone chips. As does *Signetics* and *SGS*. One source for ring detectors is *Texas Instruments.*

Power supply chips that rob phone line power are sold by *Maxim*. They do offer free samples.

A Network Interface

I just picked up a great heaping bunch of *Northern Telecomm* type 2960 network interface devices. These are an epoxy module which goes between you and your phone line. If there is any problem, their 2960 will *remotely* disconnect you. Running some simple telco tests then finds out whether the problem is your fault or theirs.

All easily handled from their front office. Without a field service call!

Note that the phone line polarity is sometimes *reversed* when they are using maintenence diagnostics.

For this reason, all direct network interface *must* include a full wave dc bridge to keep the right polarity. Of course, the phone company only fixes their own problems. Never yours.

Much more on this useful beastie in MUSE96.PDF. You can easily modify these dual bilateral analog switches into all sorts of non-phone aps. From pulse generators to LED flashers to antique radio test generators.

You basically have an isolated pair of bilateral analog switches. These snap on when their terminal voltage exceeds 17 volts.

They snap back off whenever the current through them reverses or else drops under three mils. There's also several tantalum caps and zeners and such in the module.

Let me know if you want some of these to play with. Yeah, I've also got full specs available.

This Month's Contest

Let's have three different contests this month. Tell me about some telco resource I don't know about. Or find a new ap for the 2960.

Or find me a buyer for the three cubic yards of *Northern Telecomm* 2960 network interfaces currently piled up in my driveway. These are clean and unused 1988 production. Sadly, there are not quite enough of them to glue together to make a carport.

Pretty close, though.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all

By the way, I have just posted the insider secrets to winning just about any trade contest to CONTEST.PDF.

Even more by the way, I have just bought an *entire* community college electronics department at auction. So I've got some really great one-time buys. Especially Tektronix. You can write, call, or email for a current list.

Let's hear from you. ✦

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Don Lancaster's

RESOURCE BIN

number forty-eight

Solar and alternate energy resources.

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See the trailer blurb for details.

Solar Energy Today

I guess we are long overdue for an update on solar and alternate energy. Certain recent developments (such as passive solar, construction alternates, and control films) are really coming along just fine. Others (like solar hot water) are more or less cost effective in some regions some of the time. But the big one (off-grid solar electricity) still has *serious* problems.

Ferinstance, the largest solar power plant in the world shut down a few years ago. All of their panels are now getting retailed to the hobby market. Today, there is *much* more money to be made in selling surplus junk than there ever was in solar electricity.

Now, out here on any hot Arizona afternoon, there's up to 1200 watts per meter of peak incoming solar energy. Given an efficient enough converter, an average house roof could produce $45,000.00 worth of electricity a year. Around *thirty times* what is normally used by the folks living inside.

But efficient converters do not exist. And any solar rooftop system whose amortized yearly cost is $45,000.01 can end up less than useless.

The first key problem is that silicon solar cells only respond well to *one* particular frequency of light. The light energy is proportional to wavelength. Longer wavelengths do not generate electricity and are thus wasted as low grade heat. And all the "spare change" excess energy from any *shorter* than needed wavelength also burns up as useless heat. Thus, your best possible theoretical efficiency of a silicon cell is only 28 percent.

The second thing that really gets to you is what I call the *nickel and dime effect*. Start with a less than perfect solar cell, losing "a little". Production yields often lose "a little" more, giving less than expected results.

You'll lose "a little" if your cells are made from amorphous silicon rather than single crystals. And then lose "a little" because of your anti-reflection coating. You lose "a little" because the cell wires shade themselves.

You'll lose "a little" because of your protecting glass. You'll lose "a little" because the cells don't fully cover the expected area. You lose "a little" as the cells age. You use "a little" because of tracking losses.

NEXT MONTH: Don looks at the very fundamentals of nutting and volting.

You'll lose "a little" in your system wiring. You lose "a little" in the series protection diodes. You'll lose "a little" because the ac power converter costs money and is not 100 percent efficient. You lose "a little" because any storage batteries also cost money and are not anywhere near totally efficient.

You'll lose "a little" because, if you have a utility buyback arrangement, they sell you electricity *retail* but buy it from you *wholesale.*

You'll lose "a little" because of your time and bureaucratic zoning hassles.

And "a little" because of repairs.

Thus, individual cells do not a solar system make.

The third key problem is set by the *economic breakeven* limit. If someone *gave* you all the five percent efficient solar cells in the world, there is *no way* you could generate useful (110 vac at ten cents per KWH) electricity using them. Your costs of structure, land, ac conversion, labor, maintenance, and (above all) the *time value of the money involved* guarantees a net loss.

I have posted some interesting new solar conversion alternatives as my files HACK46.PDF and HACK53.PDF.

One uses direct conversion "crystal set" or "antennaifier" techniques. The other is a dye based solar conversion whose key ingredients are white paint covered by a thin magic dye layer.

Now, I have personally done solar research. And are developing closely with several others in the field. My magic sinewaves should significantly improve the cost and the efficiency of solar inverters.

But going off starry-eyed in a "save the world" mode simply will not hack it. Never did and never will.

Here, as I see it, are the key realities of solar power today…

(1) Solar is a rather diffuse energy resource. It is extremely difficult to efficiently gather and convert into any useful final electrical power form.

(2) You can now buy an *awful* lot of electricity for a mere ten cents off of your local power company.

(3) Solar success takes *bunches* of long term effort and continuous hard work. Frustration is guaranteed.

(4) Any effort that does not build upon the existing resource base and the already done research is doomed to failure. Fer sure.

(5) The "nickel and dime effect" will eat you alive. Every time.

(6) Alternate energy projects *must* include a total economic efficiency analysis. Including time to breakeven and the net return on investment. Plus *fully* take into account *all* subsidies, both obvious and hidden.

Nonetheless, I strongly encourage you to go out and explore solar and other energy options on your own.

Let's look at some great places to get you started...

Home Power

Richard and Karen Perez publish *Home Power* magazine. Off grid and off line in rural Oregon. This is by far your first and foremost resource for low end, shirtsleeves "them that's doing" info. Besides solar, they are into wind and small scale hydro. Plus electric cars, lifestyles, insulation, the electronic fundamentals, lower priced home construction, and much more.

There are several other solar and alternate mags. *Home Energy* is mostly on how to insulate trailers. Its more of an industry trade journal than an end user publication. The original *Muddle Earth News* has long since yuppified. Its solar stuff now seems in the same league as *Popular Science*. Both seem useful, but big bucks, yuppy-oriented, and ad driven.

Much of the original Mother crew have set out on their own, publishing a fine *Backwoods Home* magazine. Still in the spirit of the original.

Backwoods Cabin is one imitator.

My most preferred ongoing "access to tools" resource of all time still is the quarterly *Whole Earth Review*, who've recently published their *Whole Earth Millenium Catalog*.

One good source for many listings of those labor-of-love alternate energy newsletters is *Factsheet Five*. Another "must have" favorite of mine.

Solar II CD

The *Home Power* folks have also just published a new *Solar II* CD. This one is a large collection of highly useful solar energy resources. Acrobat files, color, and sound. Cost is around $29.

Don't miss this one. It has to be the most outstanding product in alternate energy research today.

World Renewable Energy Directory

This one appears to be the standard industry reference. The full title is *The World Directory of Renewable Energy Suppliers and Services 1995*. This is a European publication from *James and James Science*. ISBN is 1-873936-40-0. I do not know the price. It is free to at least some industry insiders.

Included are 6000+ suppliers from 100 countries. Plus hundreds of solar organizations world wide.

The topics covered include general articles, biomass, rational energy use, energy storage, geothermal, hydro & wave, instrumentation, photovoltaics, solar thermal, and wind power.

Real Goods

The highest profile retail direct mail supplier of alternate energy products does appear to be *Real Goods*. They do have everything from solar panels to efficient lights to books to control films to warm clothes. All in their free catalog. The catalog also includes lots of solar reference info and other tips and techniques.

Speaking of efficient lighting, I've just posted a fundamental review of lighting efficiency tradeoffs as my file MUSE95.PDF to *GEnie* PSRT.

Solar Energy

The leading scholarly publication is *Solar Energy*. It's British and "a little" expensive at $1200 per year. As the official journal for that *International Solar Energy Society*.

Subscriptions are much cheaper if you are a society memember.

This is *the* place to go for first rate technical research. A larger technical library should stock these.

My favorite journal for theoretical energy fundamentals is *Science*. Their December 1, 1995 issue shows what may end up a major breakthrough in fuel cells. On page 1440.

Nature is another superb scientific journal on energy fundamentals.

Both *Power Engineering* and *World Cogeneration* are trade journals. Both are free to qualified subscribers.

Another free trade journal I have found to provide useful solar stuff is *HVAC News*. An oversized shopper for air conditioning contractors.

Solar Today is the "gee whiz" solar publication from the *American Solar Energy Society*. Sorry, but I feel that, at best, this one is second rate.

The free *NASA Tech Briefs* also has

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47 Kentish Town Road
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Northeast Solar Assn
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Greenfield MA 01301
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NM Solar Energy Assn
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(505) 243-3212

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Oak Ridge TN 37831
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Office of Energy
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Washington DC 20523
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Oregon Solar Assn
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(503) 244-7699

Pennsylvania Solar Assn
5919 Pulaski Avenue
Philadelphia PA
(505) 244-7699

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Ukiah CA 95482
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Solar Industries Assn
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Washington DC 20001
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Tarrytown NY 10591
(914) 524-9200

Solar Engineering/ASME
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New York NY 10017
(800) 843-2763

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Boulder CO 80301
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Safford AZ 85546
(520) 428-1092

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Hawthorne CA 90250
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Texas Solar Assn
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Austin TX 78761
(512) 345-5446

US Dept of Energy
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Washington DC 20585
(202) 586-1720

Whole Earth Review
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Sausalito CA 94965
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Kew Gardens NY 11415
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Albuquerque NM 87125
(505) 242-5354

some government solar stuff in it. The overwhelming majority of its content seems to me to "just barely" miss.

With the exception of *Sandia Labs* who do offer outstanding solar design services, much of government solar power has ended up less than stellar. A largely counterproductive waste.

At least out here in California and Arizona, an alarming fraction of all those outrageous solar subsidies from a decade back were simply gobbled gone by boiler shops and fast buck artists. As investment scams.

One federal demonstration school solar cooling project in the southeast found it worked "a little" better if you added a five ton evaporative cooler to the output. But then somebody asked how big an evaporative cooler they would have needed *without* the feds solar cooling involvement.

The answer: *Three tons!* Oh well.

Online Resources

There's bunches of online solar and alternate energy resources. Many are listed in the Solar II CD. You can also use the usual directories and guides to get a complete listing. One good choice is *yahoo.com*

Let's look at two samples…

solstice.crest.org provides an older collection of traditional solar reports and pubs. Apparently a DOE effort, its last update was in 1992.

umbra.gsfc.nasa.gov/sdac.html holds a *Solar Data Analysis Center* data base providing information relating to the study of the sun. Astronomical stuff like eclipses and solar flares.

By the way, these two have been excerpted from the new *Gale Guide to Internet Databases.* One of many new printed Internet guides. In general, those online guides, CD's, and search services have more listings and more current info than printed ones.

I have also posted a long list of electrical and electronic Internet sites to my *GEnie* PSRT as MUSE94.PDF. And, of course, the *Dialog Information Service* can be used to instantly find information on any solar or alternate energy topic. By way of your nearby library, on *GEnie*, on a CD ROM, or from the other online services.

Solarjack and Zomeworks

You will find lots of solar suppliers listed in *Home Power* magazine and on their Solar II CD ROM. A pair I can heartily recommend are Jim Allen's *Solarjack* and Steve Baer's *Zomeworks.* Both have been hard workers clearly in it for the long haul.

Solarjack is one of the scant few successful tech industries here in the Gila Valley. Their specialty is ultra high efficiency water pumps. All fully solar compatible. All made locally on fancy CAM production machines. Jim also sells the *Solec* panel modules and similar products.

Jim's first secret to survival is to address the "Uh–Compared to what?" markets where solar power is the *only* solution. Locations like Bolivia, the Narobi desert and a few remote sites on Arizona Indian reservations.

His second secret is integrating the components into an entire workable system. Pumps get fully optimized to panels. While minimizing the nickel and dime effect.

Zomeworks has been in business since solar year one. In fact, Steve's labor-of-love *Sunspots* publications long ago defined the opening spasms of the alternate energy revolution.

Today, Steve recycles those "gold" *Carizzo Solar* panels. He also provides efficient and effective solar trackers, energy control systems, passive solar products, and new *Cool-Cell* battery coolers for remote utility sites.

EPRI and AEE

The *Electric Power Research Institute*, or EPRI for short, has all sorts of solar and alternate energy videotapes and publications. Their membership is a tad pricey at a quarter mil per year. That's for an individual. I didn't ask what their family rate was. But most

of their research materials are offered on a cash-and-carry basis.

They also publish an *EPRI Journal.*

Most of their research is first rate. They are basically a consortium of big electric utilities. Grants are issued to study just about any and all energy options. Ranging from coal, oil, and nuclear on up through solar, wind, and conservation.

The *Association of Energy Engineers* is a professional trade group. They have an outstanding bookstore on just about any and all energy issues. They also do get involved in seminars and industry shows.

Yet another major energy resource is the *Rocky Mountain Institute* run by Amory Lovins. Thorough studies about everything from economics of home energy conservation to new options in hybrid electric vehicles.

Straw Bale Homes

There's a lot of fresh new interest in straw bale house construction. The bales are potentially cheap and offer fine insulation qualities. And they are more managable than they might first seem. At least around here, zoning officials seem surprisingly receptive.

A really superb series of videos on straw bale homes gets distributed by *Black Range Films.* Including guided tours and detailed step-by-step and hands-on construction details.

Be sure to check these vids out. The same people do alternate construction seminars and run an outstanding (and reasonable cost) wilderness bed and breakfast lodge. Hidden deep in the top secret portion of New Mexico that you can't get to. I'd be happy to meet you there most any time.

Free brochures are offered. Be sure to tell Cathy I sent you.

Magic Sinewaves

My own in-process contribution to solar energy is a brand new technique called *magic sinewaves.* Compared to older PWM pulse width modulation, the magic sinewaves greatly simplify solar inverters and make them much more efficient.

Magic sinewave ac power inverters can run much cooler, using lower cost output transistors and more compact heatsinks. Related magic sinewaves can work with induction motor speed controls and electric autos.

I've got full consulting services and codeveloper programs available on these. All the tools are functional and in place. Including source code and working chips. If you write, email, or call, I'll be happy to send you a free tutorial reprint on magic sinewaves. You can also pick this one up as file MAGSINT.PDF on my *Genie* PSRT. Or, for scads more detail, search the PSRT library by using "magic" or "Fourier". Dozens of the latest files are offered on this billion dollar opportunity.

This Month's Contest

For our contest this month, just tell me about some solar resource I don't already know about. Or tell me about some alternate energy story you have been involved in.

Or tell me about most any solar or alternate energy online resources you happen to have discovered.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

Send all your *written* entries to me here at *Synergetics*, rather than to *Nuts & Volts* editorial.

To be fair to everyone, all entries must be printed and mailed.

Acrobat quality reprints of all my *Nuts & Volts* columns are available on *GEnie* PSRT. This particular one is called NUTS48.PDF. Another alternate energy resource summary appears as my HACK28.PDF file.

A reminder: I have just bought an *entire* community college electronics department at auction. So I have got some great surplus buys. Especially Tek logic analyzers. You could write, call, or email for a free catalog. Or grab it as SURPCAT1.PDF.

Let's hear from you. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 33 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GEnie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For modem access: (800) 638-8369. When prompted, enter JOINGENIE. When asked for an offer code, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.COM