Don Lancaster's

RESOURCE BIN

number sixty three

A painless way to scam a student paper.

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.

I'm now in the process of setting up my new *Guru's Lair* web site you will find at (where else?) *www.tinaja.com*

This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprint sets for all of the *Resource Bin* and other columns.

You will get the best results if you have both *Netscape Gold* and *Acrobat Reader 3.0*. You download these from *www.netscape.com* or *www.adobe.com*

Scamming a Research Paper

OK. It's 11:43 pm and your semester paper is due at 8 am for tomorrow's class. So far, your extensive, careful, and dedicated research has more or less narrowed down a suitable range of possible topics. Sort of.

What to do?

I should not have to belabor all the obvious rules here: By far your best way to submit a thick report is to use thick paper. Form counts ridiculously more than content. So, be certain to use the glitziest materials, foil inlaid perfect bound parchment covers, and full color laser printing with bunches of fonts. Always be sure to place style over substance.

Make sure there's at least 23 entries in the bibliography. Always do make absolutely certain your instructor gets personally and lavishly referenced for not less than *one-third* of them.

But what if you also wanted to bust the curve by having actual *content* in your paper? Within your time frame, of course. And while never, but never, actually learning anything?

The trick is to hit the web running with a winning topic. One which your instructor has not heard of, but sorely wishes he had. And stuff that nobody else is likely to come up with.

Here is how it is done: Get on the web. Click to my *http://www.tinaja.com* Next select the *Surf to interesting web sites* button. Select the *Web related sites* button. Select the *Search all sites at once* button. Then scroll to *Alta Vista.*

Punch the topic into Alta Vista. Get the first twenty or so entries, ignoring false hits. Or most weaker ones. Print the good guys out. Read all the sheets and mark them with a page highliter. Scan or key in the highlighted words.

Print and submit your paper.

More on doing web research can be located on the *Webmaster* library shelf of *www.tinaja.com*.

Especially check RESBN60.PDF

Here are my current selections for a few sure-fire paper topics…

Aerogels

Aerogels are the fifth state of matter that consist of a solid suspended in a gas. Sort of "solid smoke". Aerogels are astonishingly light and are superb insulators. They are often made from silicon, but carbon versions have been made from seaweed. Aerogels block heat and sound but freely pass light. Some now offer optical clarity good enough for energy efficient windows and skylights.

NEXT MONTH: Don shows methods to explore Usenet, newsgroups, & newsletters.

Other uses include everything from capturing tiny meteors to advanced batteries to light loudspeaker cones to desalinization of seawater.

One printed source of aerogel info is that *Journal of Non-Crystalline Solids.* An aerogel tutorial site can be found at *eande.lbl.gov/ECS/aerogels/sabib.htm* An intro and aerogel resource list do appear in my MUSE112.PDF

Archaeomagnetism

Any magnetic mineral or material has a *Curie point* above which it loses all its magnetic properties. If you heat anything above its Curie point, apply a magnetic field and then cool it, the strength and direction of the magnetic field should get "locked" in. Making a somewhat permanent magnet.

The earth's magnetic north pole is nowhere near true north. It wanders all over the lot. The poles might even suddenly *reverse* themselves. Literally flipping out. Both effects are caused by chaotic pertubations of the earth's magnetohydrodynamic field. Records of this *polar wandering* over time are readily found.

At any point on the earth, the pole wandering will create a change in the *declination* and *inclination* of the field vector. Take a ceramic pot with some iron minerals in it. Fire it. The heating removes all the previous magnetism. Then cool the pot. Your cooling locks in the inclination and declination of the earth's magnetic field.

Since most pots are fired rightside up, any piece of any pot should hold a record of the magnetic inclination that matches the polar wandering position at the time of firing.

Giving you a powerful prehistoric dating tool. Called *archaeomagnetism* One that can tell you an absolute date if you already have a ballpark guess. Telling you how far distant tradeware pottery ranged. You'll have to be very careful to preserve the *exact position* of the pot before you make a lab test.

You could also find the last time a firepit was actually used. Once again, by carefully orienting a sample before you remove it for analysis.

If you are more interested in rocks

than pots, you refer to the same effect *Paleomagnetism*. Then apply it to study the history of rock formations.

Or to study those polar wanderings all by themselves.

I did a tutorial way on back in the September 1969 *Electronics World* on pages 23-26+. Lots of newer material is easily found on the web.

Buckyballs

Until recently, a mere two forms of carbon were known to exist. Ultra soft graphite and ultra hard diamond. But a bizarre third carbon form was found only a few years back. By selecting 20 hexagonal arrangements of six carbon atoms and then fusing them with 12 pentagonal groupings of five carbon toms, a *hollow* geodetic pure carbon molecule of 60 atoms is created.

Because this hollow all-carbon C-60 molecule appears just like a geodetic dome or a soccer ball, it was named after the late Buckminster Fuller, one leading early proponent of geodetic dome structures.

Potential buckyball uses do include super lubricants, new batteries, ultra strong fibers, better semiconductors, and entire new classes of materials.

Buckyballs are now fairly low cost. One source is *MER*, short for *Materials and Electrochemical Research*. You will find a thousand or so web hits on this leading edge topic. My take on all this appeared as HACK43.PDF.

Magnetic Refrigeration

It would be wrong to call this a hot topic. Because it is really an extremely cold one. Brrrr.

As we saw with archaeomagnetism, anything magnetic has a *Curie point*. Above which it is no longer magnetic. If you magnetize something, you raise its internal energy. If you then heat it above its Curie point, the magnetism "goes away". Releasing stored energy in the form of heat.

This process is sometimes called the *magnetocaloric effect*.

At some low temperature, you put energy in. At higher temperature, you take energy out. Other names for such devices are *heat pumps* or *refrigerators*.

Magnetic refrigeration is best suited for cryogenic and related lower temp apps. Although it someday may see a few room temperature uses.

Efficiencies as much as 40:1 better than mechanical systems are possible. One good material is gadolinium. The temperature range is carefully chosen so that the heat *source* ends up *below* the Curie point. And your heat *sink* is *above* the Curie point.

The horse's whatever paper on this is Andri Andreenco's *Magnetocaloric Effects in Rare Earth Magnetic Materials*. Appearing in *Soviet Physics Usp*. On pages 32-39 of Volume #8 for August 1989. I have got some references and background info in HACK33.PDF and HACK35.PDF.

Mass Teleportation

Lots of quiet progress has recently been made in this arcane field. Start with Barfoot and Gentry's tutorial in the *International Journal of Teleportation & Mass Transference*. Way on back in Volume XVIII, pages 1146-1198+. Also check out the construction project by Chediski, Colcord, and Elden in the same issue on pages 1245-1277.

A key component is the brand new short ultraviolet solid state laser from *Atascotia Industries*. This $1.49 device has a 5.0 watt power rating (when it is properly heatsunk) and is quite easily coupled to any suitable dissociation or association chamber.

Using fiber optics.

Plug-in cards for both teleportation transmission and reception are newly offered for the more popular personal computers. For sane replication times, a 33K modem is needed. *Swampfelder Industries* is a leading supplier.

These mass teleportation cards are very much in demand by importers of specialty herbs and spices. The card's 4X long distance cloning feature can completely eliminate all of those long lines at Customs. It also lets you set your own foreign currency exchange rates as well.

Additional details appeared back in HACK16.PDF.

The Mystery Band

How far is it from radio to heat? A lot further than most people believe. Radio microwaves top out at 100 Gigs or so. Heat starts at 3200 gigs. Leaving a humongous *five octaves* of largely unused and unregulated spectrum. A spectrum so vast that everyone in the world can have a dozen of their very own private HDTV stations.

Others refer to the mystery band as the *submillimeter wavelengths*. We are only now beginning to discover how to create signal sources, amplifiers, or oscillators at these frequencies.

Radio astronomers often use a pair of windows in this frequency range to listen to the universe. Sometimes by using a diode and downconversion to

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Academic Press
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San Diego CA 92101
(800) 321-5068

Adobe Acrobat System
1585 Charleston Rd
Mountain View CA 94039
(800) 833-6687

American Scientist
Box 13975
Research Tri Pk NC 27709
(919) 549-0097

DTM
1611 Headway Cr B2
Austin TX 78754
(512) 339-2922

Exar Corp
PO Box 49007
San Jose CA 95161
(408) 732-7970

Harshaw Bicron
6801 Cochran Rd
Solon OH 44139
(800) 472-5656

Jnl Infrared & MM Waves
233 Spring St
New York NY 10013
(212) 620-8495

Jnl Non-Crystalline Solids
Box 945
New York NY 10159
(212) 633-7300

MER Inc
7960 S Kolb Rd
Tucson AZ 85706
(520) 574-1980

Netscape Gold
501 E Middlefield Rd
Mountain View CA 94043
(415) 528-3777

Scientific American
415 Madison Ave
New York NY 10017
(212) 754-0550

Stratasys
14950 Martin Dr
Eden Prairie MN 55344
(612) 937-3000

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

3D Systems
26081 Ave Hall
Valencia CA 91355
(805) 295-5600

Vortec
10125 Carver Rd
Cincinnati OH 45242
(800) 441-7475

"Get out of Dodge".

Your untapped opportunities here boggle the mind.

The leading publication seems to be that *Journal of Infrared and Millimeter Waves*. Good web search keys include "submillimeter" and "Terahertz". I did an intro in HACK84.PDF.

Santa Claus Machines

Otherwise called *rapid prototyping*. Any scheme to construct solid objects from a data base or a comm channel. Letting you replicate a car part, a $20 bill, or a roast beef sandwich.

We already have a few of these RP machines available today. But most of them are remain a tad pricey. Like a house and two cars. And so far, the roast beef sandwiches leave a distinct acrylic aftertaste.

But these are low in cholesterol and totally fat free.

One early RP method uses a laser to selectively harden a photopolymer. A second uses a scanning laser to sinter together zillions of very tiny metal or plastic spheres. A third is basically a high tech glue gun extruding plastic string. A fourth uses inkjet techniques to selectively apply the hardener. You will also find a dozen or more "also ran" technologies competing for some really big megabucks.

Leading companies here are *3-D Systems*, *DTM*, and *Stratasys*. *The Edge* is a 3-D Systems house publication. My Santa Claus columns are HACK01.PDF, HACK36.PDF, and HACK47.PDF. See HACK77.PDF as well.

Solitons

A *soliton* is a very specialized pulse waveshape. One originally observed from a canal bank hundreds of years ago. A wave that "goes forever".

A soliton can have the remarkable property that it "rebuilds tself" as it travels along. Neither squashing itself together nor spreading out. Solitons demand a slightly nonlinear media that they precisely interact with.

Solitons let you transmit fiber optic communications all the way around the world without repeaters. They are basically a way to communicate faster over longer distances.

One project I would sort of like to develop is a soliton water cannon. Or more correctly called a *monitor* or *deck gun* by us fire service folks. Effective firefighting streams tend to max out at 250 feet. There's lots of times when you'd want to reach a lot further.

Sure enough, when you turn your garden hose on and off uddently, an initial "packet" of water spurts much further than the steady state stream. Can you "soliton" these packets into a controllable and effective long range stream? Big bucks here.

While long distance comm is your soliton biggie, the latest f studies are on microminiature *soliton circuits*. In which tiny wave pulses communicate with each other going over a special conductive nano scale plastic. These can reduce integrated circuit sizes by *thousands* of times.

There's tons of soliton info on the web. One fairly good print tutorial is Russell Herman's *Solitary Waves* in *American Scientist* for July-Aug 1992. I did a soliton tutorial and a resource listing back in HACK77.PDF.

Sonoluminescence

Sonoluminescence, otherwise known as "light from sound" is an emerging research topic having some stunning new uses. Take a small flask of water. Then couple it to a 25 kHz ultrasonic transducer. Cavitating bubbles should rapidly form.

Some of the collapsing bubbles will emit blue light!

What is apparently coming down is that the sonic energy gets spherically focused by as much as *twelve orders of magnitude*. Their blue light is actually uv centered on 310 nanometers. The collapse heats the air at the center of the bubble to 10,000 degrees.

And possibly *much* higher.

Even more intriguing, all of these light pulses are a mere 50 picoseconds long. Future uses include generating light pulses for use in laser research and spectroscopy. And–just maybe–a new fusion-related energy source.

There's some 500 sonoluminescence hits on the web. Including some great tutorials. A construction project was in the *Scientific American* for ebruary 1995. In the *Amateur Scientist* column, pages 96-98. My own backgrounder is HACK73.PDF.

Thermolumnescence

Take a piece of limestone. Gently crush it and slowly heat it to kitchen oven temperatures. Chances are the powder will emit light. But only while being heated. And only while the heat is increasing. Cool it and repeat the process. Nothing happens. Why?

Ceramics, selected chemicals, and certain geological materials have tiny atomic features inside themselves that are called *traps*. Should some nuclear radiation show up, an electron might get blasted into a higher level trap. Heat the trap, and the blasted higher level energy gets released as a flash of light. Reheat it, and nothing happens because the trap is empty.

The higher the radiation, the more energy in the traps. And the more the recovered light on heating.

This light is *thermoluminescence*. Uses? Disposable dosimetry badges. Geological dating. Finding out if a potsherd is ancient or modern. (The old one will thermoluminesce. The

modern one will not.) Lunar research because the moon thermolumineses.

Harshaw Bicron is one main source for badges and instrumentation.

McDougall's *Thermoluminescence of Geological Materials* is ne text. From *Academic Press*. Also see my ancient story on this in the March 1969 issue of *Electronics Now*. On pages 43-46.

Vortex Coolers

Take a magic "Tee" shaped pipe. An "empty" one having no moving parts. Blow air into the middle. Believe it or not, *cold* air comes out one end and hot air will come out the other. To -40 degrees, even.

These are often called *Hilsch Tubes* or *Ranque-Hilsch Tubes*. An adjusting screw can let you optimize for lowest temperatures, maximum cooling, or anything in between.

How does it work? By conservation of momentum. A high speed hollow *vortex* gets created on your inlet side. Some of your air will go out your hot exhaust, while the rest continues as a vortex *inside* the input one.

Since the angular momentum of a smaller radius stream has to be lower, energy has to get transferred from the input stream to the output one. Thus heating input and cooling output.

Apps? Everything from cooling the needles on large sewing machines to keeping temperatures down inside of electronic cabinets.

Although the efficiency is typically rather low with a COP of only 0.4 or so, the actual energy goes in at the air compressor across the room. All the excess heat gets dumped out its own pipe. Unlike a thermoelectric device where heat from its incredibly poor efficiency ends up in the wrong place.

Two leading suppliers are *Vortec* and *Exair*. There's a rich selection of web sites on this subject. My intros are HACK35.PDF and ELEGSIMP.PDF.

Some Also Rans

I guess we are pretty near out of room. Other workable paper subjects include GPS (MUSE92.PDF), Fibonacci Sunflowers (in MUSE89.PDF, Electric Discharge Machining (HACK60.PDF or HACK63.PDF), Fractals (HACK25.PDF and HACK47.PDF), and Wavelets (try HACK38.PDF and HACK49.PDF).

This Month's Contest

For our contest this month, just tell me any sure fire winning subject for a student paper. One that meets the guidelines we ust looked at. Or send me a copy of your paper on any of the above topics. Or one that belongs on the list that I've overlooked.

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. ✦

Microcomputer pioneer and guru Don Lancaster is the author of 33 books and countless tech articles. Don maintains his no-charge US tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and consulting services. Don also has two free catalogs full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is in the process of setting up his Guru's Lair at http://www.tinaja.com

Full reprints and preprints of all Don's columns and ongoing tech support appear here. You can reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his US Internet address of don@tinaja.com