

Fun With Stuff

There are a lot of loose ends I have been meaning to mention one way or another. So, I guess we'll do a "mixed bag" type of thingy here. One which reviews some of the recent items that I've either been working on or have found of more than passing interest...

Bubble Accelerometers

I've long been interested in *Navicubes* which is what I call a small and not-quite-here-yet \$5 box that always knows where it is, which direction it is facing, and which way is up. Besides vehicle nav, intelligent toys, and robotics, these would open up all sorts of neat tricks. Such as a ball you could simply bounce off cave walls for mapping. Or mail to somebody to tell them where you live. Simply zero out the numbers in your travels, and you have arrived.

Today, *GPS*, *gyros*, *compasses* and *accelerometers* all offer partial and often pricey *Navicube* solutions.

The *Memsic* folks have come out with some stunning new ultra low cost accelerometers. Which are nothing but a bubble of air that's placed inside a sealed can. Unlike most piezo accelerometers, these offer a response down to dc and easily double as inclinometers. Even better yet, they are inherently two-axis devices.

Dozens of models offer absolute, ratiometric, or digital outputs. Their MXA2999GL is a typical ratiometric device, offering 1 g full scale, a 1 milli-g sensitivity over an 0.2 milli-g noise floor and a 1 volt per g output centered on a 1.25 volt bias. Free samples and ap notes are found [here](#).

Basically, an air bubble is heated, and heat convection gets measured by thermopiles arranged in four directions. Acceleration will cause heat convection and differential heating. This gets measured and output as g values.

While equal to traditional proof-mass accelerometers, use of a gas bubble eliminates stiction and contamination, and survives up to 50,000 g without damage.

Besides being ridiculously cheaper.

Because the rate of change of position is velocity, and the rate of change of velocity is acceleration, you can work backwards by doing a double integration. You integrate (or mathematically sum) acceleration to get velocity and then integrate velocity again to get position.

One problem common to any accelerometer positioning sensing is the "*Tee squared error*". The least little dc error will pile up as time squared and is guaranteed to eventually get out of hand. Thus, accelerometers ultimately have to be reset or compared against GPS or whatever.

Even if you do not own a tee square.

Inclinometers can be built by using these to respond to the g-force of gravity in absence of any other acceleration. And then doing a sine table lookup calculation. Per their AN-00MX-007 ap note.

More traditional accelerometers are now offered by *IC Sensors*, *Invensys* (formerly *Sensym*), *Motorola*, and by *NovaSensor*.

Several other useful *Navicube* resources include various resources from the *Institute of Navigation*, and the trade journals such as *Sensors*, the *IEEE Sensors Journal*, or *ITS World*. As in *Integrated Transportation Solutions*. Plus, of course, our own *Navicube* and *InfoPack* library pages on my *Guru's Lair* website.

Tut's LR2000T HPNA Adaptors

I recently picked up a great heaping bunch of brand new and mint *LR2000T* Home Phone Network Adaptors by *Tut Systems* from a telecomm bankruptcy. And do **have them available** for around eight cents on the dollar.

Since these cheaply and easily let you put an Ethernet network on top of all of your existing internal phone lines **without voice interference**, there's some really amazing new possibilities here.

Each LR-2000 is basically a small modem like device that intercepts a phone line of your choosing and superimposes Ethernet or Internet onto the line. As DSL-like frequencies are well above audio, you can still use the same phone line for normal voice calls without interference!

The format used is called *HPNA* and is short for *Home Phoneline Networking Alliance*. You can pick up some free *HPNA Videos* from their website. And a free review of their tech specs is offered by *Digit-Life*.

What makes these low cost units so exciting is that they apparently can do so much more than just their apparent intended use.

Normally, an apartment, dorm, or trailer park owner will buy an expensive MDU *multiple dwelling unit* and then install it in their phone front end. Their MDU will receive some internet from somewhere (T1, phone, wireless, cable, etc...) and then add the web to the phone lines going to the individual rooms, units, or trailers. Each renter then uses a LR2000T to pick up high speed internet over their ordinary voice phone line.

Without any special cable or software.

The big secret is that **You do not need a MDU to use these units!** Your minimum system consists of any old live or dead internal phone line or other wire and a pair of

LR2000T's. Thus, anytime you want to network Ethernet or Internet and do not want to rewire (or use unreliable power line or wireless options), these can be ideal.

Their LR2000T's have an effective range of 2000 feet and offer up to a 1 Megabaud transfer rate. Which is way more than enough for most home networking uses. Some of the ISP's I have been working with on these routinely verify 500K plus data rates from T1 and similar sources. Which is ridiculously faster than dialup internet.

Up to **twenty-five** LR-2000T's can be used on your single line network. And even more by adding hubs or routers. All routing and addressing gets done fully automatically and invisibly **without** the use of any special software or setup.

Just plug and go.

Tut calls all their HPNA products **LongRun**, while their extended range LR2000T's are called **HomeRun** adaptors. I am not certain how well the LR2000T's interact with other HPNA products from other suppliers. So you are probably best off using the LR2000T's with each other.

Other obvious uses would be letting your downstairs computer reach your upstairs printer. Or extending your Ethernet or Internet into a garage or a workshop. Or any other place you do want local networking but don't want to have to rewire with fancy cables.

Installation is trivial. Just provide for the wall wart, plug into the phone line, plug the continuation of your phone line into the LR2000T and connect to an Ethernet source.

Then repeat the process at the other end.

Another intriguing possibility is that you should be able use a stack of low cost LR2000T's and a hub or router or two to **replace** your costly MDU for budget motel/trailer/prison/hotel/office/dorm installations. By one of those utterly astounding coincidences that sometimes appear to **infest** my columns, we also do have some **Marconi BET Building Entrance Terminations** and all those optional **Z-Blocker** filters currently in stock as well.

One detail that might confuse newbies but should be immediately obvious to any networking person: These LR2000T's only work when you have access to **both** ends of an **on-premises** cable. They do **not** let you simultaneously **receive** 56K internet and voice phone over the same telco phone number! They are a "premises" solution and not a "last mile" solution. Thus, you'll have to initially get your Internet from someplace else. Such as a different phone number, DSL, cable, wireless, satellite, T1, or whatever.

There's all sorts of unique new possibilities here. You can **contact me** directly for further help on this exciting new networking opportunity.

Adobe's Acrobat 5.0.5

Acrobat from **Adobe Systems** has long been **the** way to publish anything, to do **eBooks**, or to distribute virtually all web technical content. I have long had my supporting **Acrobat** and **PostScript** library pages on my **Guru's Lair** website. These have recently undergone lots of **revisions and additions**.

Adobe's latest 5.0.5 upgrade promised some useful new improvements and features. But sadly, I felt the appearance of my files was **worse** in Acrobat 5 (and in the companion **Acrobat 5 Reader**) than on earlier versions or an **eBook** reader. One possible explanation is that Adobe had lots of complaints over their older text smoothing being "too

gray" and "too fuzzy" and threw the baby out and drank the washwater. Or that compromises were needed for their extensive new subpixel **CoolType** smoothing algorithms that dramatically increase laptop LCD display resolution.

Workarounds include using an older Acrobat or eBook reader for viewing. Or else using screen resolutions higher than 600 x 800. My files really look great if you run max screen resolution and then pick a 200% magnification. Should you see some monitor flicker at max resolution, back off a tad on your brightness and contrast.

Acrobat 5 now has the ability to directly capture HTML pages and convert them into PDF format. Either on or off line. Although they claim the ability to preserve links and even do some JavaScript, my own pages came through with no links, no **bouncy bricks**, and no wallpaper.

You can also now input directly from most any word processor to .PDF format simply by printing to an Acrobat print driver. As well as easily extract text from most PDF documents. Rich text is explicitly supported.

Portions of Adobe's pricey **Acrobat Capture** are newly available as a free **Paper Capture Plugin**. Both online and included in their upgrade CD. These can let you input a scanned bitmap of a print page (such as an older book) and OCR extract the text. Which can then either get used to provide search services or else to actually capture text.

Note that a scanned book page might be 3 Megs in size and the equivalent PDF file might be 3K. The whole trick to upgrading older books to ebooks is to convert **everything** to either captured ASCII text or else to stroked **PostScript** procedural graphics. Which is often not trivial.

I decided to try this first on my **ISMM**. I got around a 90% accuracy, split evenly between the missed words and the misspelled ones. Because I found a slightly ratty final appearance and difficult editing, I instead recaptured the ASCII text to a word processor and then dropped it back down into my **Gonzo Utilities**.

Gonzo lets me reset to "perfect" typography, add sneaky **picojustification**, and otherwise very much improve the final product. Which should eventually end up **here**.

At one time, any **transparency** effects were enormously difficult to do with PostScript. Acrobat now has extensive new transparency options. Sadly, even after careful study of Adobe's **ATN5407 Transparency in PDF**, they do remain difficult to understand and implement. Since there is no explicit PostScript support of transparency, you have to get the effects by manipulating internal Acrobat dictionaries. Or by using **Illustrator** or similar programs that do newly support transparency features.

I hope to show some transparency demos shortly.

By the way, Adobe's free **eBook Reader** still gives you the more legible "old" text smoothing. But new downloads will almost certainly switch to their new algorithms. The eBook readers are also able to read most of my files to you. Out loud. In Swedish with a Bantu accent, no less.

Yumpin yimminy.

I still have not found any way to get Acrobat's super full screen displays inside a web browser. You have a choice of using borders inside a browser by using a plugin. Or of **removing** the plugin and getting full screen by selecting Acrobat as a helper ap. More details are found **here**.

There's also a move underfoot to provide a non-Adobe variant of .PDF directly into .HTML-like web pages. This is

called **SVG** and is short for **scalable vector graphics**.

Links and other support can be [found here](#).

Much more on Acrobat, PostScript, and .PDF topics are found in the [comp.text.pdf](#) and [comp.lang.postscript](#) newsgroups. And in my [Acrobat](#) and [PostScript](#) libraries.

Tower Fans

I have long been an **Elegant Simplicity** enthusiast. And was pleasantly surprised to see the literally revolutionary breakthrough in, of all things, oscillating room fans.

The regular fans have lots of grievous flaws. The unstable center of gravity is at the top, they sweep out a broad area, they are often noisy, the hard-to-set oscillator sometimes jams, and kiddies can still put pencils through the blade guards. Besides blowing crucial papers away.

The new tower fans are basically a pole on a stick. With a modified Savonius-like rotor that is nothing but a long squirrel cage flow restricted on one side. Their switched reluctance motor is at the bottom for a low cg.

Air flow is apparently closely regulated, because if you block part of your inlet, their motor speed automatically increases. For oscillation, the unit simply rotates upon its axis, taking up no more room than when stationary.

Power drawn is a surprisingly modest 55 watts, or around one fifteenth horsepower. Since the results in an average room seem to me as good or better than a typical older fan, I suspect the large area, lower velocity rotor is much more efficient. It clearly gets a lot closer to laminar, rather than turbulent flow. I've also found equal comfort with one or two degrees higher air conditioner settings.

For additional energy savings.

There's even a remote control that sure is handy to quiet things down during a phone call or late night shutdown. These units provide for all sorts of temperature and time sensitive options, as well as their intermittent "chuff chuff" gentle breeze mode.

All price competitive with the old models.

Sadly, there might be a quality control problem, though. Mine popped its drivers after a few weeks.

A typical model is the **Airtech 84001** from **Wal-Mart**. Dozens of other suppliers can be found by using our [Asian Sources](#) links on my [Home Page](#).

Hexapods

Hexapods are a brand new way of "virtual ways" machining using "pushme-pullyou" techniques that apply only linear translation and involve exceptionally little side loading or wear. They are causing profound changes in machining, materials handling cranes, telescopes, simulators, vibration isolation, and robotics.

I have recently added an updated Hexapod section to my [Flutterwumper](#) low cost robotics library page.

These are also sometimes called **Stewart Platforms** or else **Parallel Robotics**. Instead of axes stacked up on top of each other, there are simply six crossed air cylinders or linear actuators that interact simultaneously to position a table or platform. There is thus no axis error pileup.

While very exotic coordinate transformations are needed on the fly, these are simply done with today's **PIC** or other microprocessors. Kits are even available that salvage only the frame and spindle of an ancient milling machine to convert it into a six axis CAD-CAM machining center.

About the only negatives on hexapods is that they are strange looking and have limited motion extremes. Also, very high speed machining is somewhat problematical due to sudden and nonobvious speed changes on each actuator.

The leading manufacturer is **Hexel**, while one main web gateway is the the **Parallel Mechanisms Information Center**. A useful link farm [appears here](#), Hexapod books are found on our **Book Access** library page. And, as already noted, more Hexapods are in my [Flutterwumper](#) library.

This is an opportunity not to be missed.

MEMS Antennas and Lumeloid

My previous **Blatant Opportunist** column covered some **Energy Fundamentals**. In which alternate solar electric possibilities were explored. A Dr. Alvin Marks has been a leading proponent of **MEMS** solar antenna arrays. Which are literally small scale crystal sets. And do offer potential efficiencies much higher than silicon PV. His current website is found [here](#).

Two of my own energy efficiency developments appear [here](#) and [here](#).♦

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