## BITS, BYTESEPIXELS

LIMA 99/4A USERS GROUP



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LETTER from AUSTRALIA - No. 5 Jun / 93

Somehow here at funnelweb Farm we seem to have been under siege from some of the local wildlife. No, not the tunnelwebs! Earlier in the year we returned after a weekend at Hawks Nest to find the fireplace mesh screen knocked over. A possum, not one of our regulars as it turned out, had come down the chimney while we were away and was still in the house. In the china cupboard in fact. This contained all the hand made wine glasses, glass ones from a local craftsman, and pottery goblets that Val had made at the city recreation department's old firehouse when we were in Boulder, CO in 78/79 for a year, and which had survived the trip back to Australia. Eventually we managed to extract it with loss of only a few items. When we finally coaxed and shoved the possum into an old potato sack it quit snarling, biting and scratching, and just went all limp. Played possum as the saying goes. Released it down the back and it went scampering off into the trees.

Just the other week daughter Eileen visited home while we were away to tind a kookaburra in the house. It had crashed through a pane of class and could not find its way out again. It had been there for a day while everyone was away, behaving like a pigeon with a statue. A few years ago another crazy kooka took a fancy to dive-bombing the windows at Hawks Nest. They have very powerful heaks and can make quite a thomp. I do not know how this one got started - maybe it thought it saw a reflection as a rival and liked the feeling of hitting the window - or maybe knocked itself into a psychotic state. You could be standing on the veranda with Krazy Kooka up in one of the trees, and it would come zooming in, fly a tight semi-loop around you, and then crash into the glass. The neighbours were complaining about the constant thump thump which went on for weeks. We ended up with flattened cardboard packing boxes and chicken-wire nailed up over the windows to discourage it. Come to think of it, I haven't heard any whipbirds for some while. Better not have been the bloody cats killing them off.

Uniy about a meter away from the TI 1 have a 486 PC. There is something about it that reminds me of the TI-99 experience. No, it is not the machine itself but the fact that it is running IBM's US/2. It is an excellent operating system, in fact the first decent one on that powerful but disquistingly ugly intelliplatform. So there it is, a fine piece of work put but by a very large company which has consistently stuffed up its product development and marketing, and is beset by a competitor with grossly interior product which gets all the support and magazine hype, no matter how bad or undelivered its products are. The wheel

seems to have turned full circle. Do I really want to get into all this again ?

I now finally have Internet access from my office computer, another 486, and have been looking at the posts on comp.sys.ti which is the only ll stuff I can find. A recent common theme has been PE-box and card dissipation. I will not remash that here, but will reflect instead on how electronic equipment cooling should be done. The thing that strikes me is how badly air flow in typical FCs is handled. If you have ever seen an old Tektronix oscilloscope you will appreciate how it should be done. A large cooling fan om the back draws air in through a filter, and this clean air them blows through the equipment and finally out the ventilation holes. It needs occasional maintenance by filter cleaning of course, but deposits the minimum of dust and crud inside the box. The TI PE-box shows a lot of its industrial heritage in its air distribution system, the only thing lacking is filtering of the air as it is drawn in. The typical PE seems to be very haphazard in this regard, even some from big companies that should know better. A couple of weekends ago William and I visited Ben Takach in Sydney. Ben is a long-time (1-99 and CC-40 stalwart, but he was fixing a genuine 18M PS/2 at the time for a relative. The ventilation in this was so designed (if the word can be used here), that if a disk were in the floppy drive the cooling air was drawn in through the opening of the disk drive and finally exhausted out the back. So this "design" drew dust-laden air directly from outside through the most mechanically delicate item in the box. You guessed it. Ben had just had no alternative but to replace the floppy drive at great expense.

Progress never seems to be a steady forward trend, and often seems to involve steps backwards as well as forwards. The small computer graphics and tilm outfit in Sydney where Will had been working is contemplating a move to Silicon braphics machines. Up to now they have been working on a network of PCs, hardly ideal for serious graphics work. So Will wrote some test programs for comparison purposes and sent them over to S61's local office. The first of these was an image analysis program that involved lots of floating point calculations. As expected this ran very much faster than on a 486 DX/50 though I am not so sure just how it ranked as speed for money. PCs are uply but give a lot of raw power for the buck, while S61 machines though elegant, are very expensive indeed. The second, about 2 pages of ANSI U code, was an image cross-fade program using 32-bit integer pixel values. They did not hear back for over a week from 961, and then it was a low key admission that the program in fact ran faster on a DX/50 PC than it did on an R-3000 based 56) machine, and more embarrassing still was even slower

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again on a 361 K-4000 machine. They had been trying for the week to optimize it, and would not admit to just how much slower it actually ran. The reason turned out eventually to be second level cache thrashing in the 561 machines, and they ran much faster on smaller data sets. What is more the the actual comparison found when they had the 561 machine in for evaluation showed the K-4000 only half as fast as the DX/50 on this integer task. That is not what you buy a bigger and more expensive machine for, and shows that even the most gold-plated engineering does not always get it right.

There does seem to have been some kerfluffle over various CPU memory expansion schemes, either available or proposed, in the public electronic media, as visible here on comp.sys.ti. As is usual smouldering discussions seem to generate more heat than light. So why not a few outsider's comments in review for this letter, which hopefully will add a little light.

There have been minor league plug and play CPU memory expansions around for the TI-99/4a for years now. The "supercart" was the most common of these, and extended versions of this which bank more memory are around but not common. Their rarity, limited 32K typical total size, and most of all incompatibility with Extended Basic, have precluded any serious software development.

Utf to one side we have the RAMdisks. The Horizon family banks KAM in the DSR area, but only in small 2K secments at one address. The banks are small, and the CRU structure is messy. All in all I think they are best used as RAMdisks emulating physical disks as closely as possible and as fast as possible. Auto-booting has been the subject of earlier ietters. My locally designed and made Quest RD is much cleaner in CRU assignment but is a rarity in general terms. The KAMBU modification for big HKDs is in principle an advance with hardware changes for BK blocks mapped to the cartridge KUM/KAM space and DSR software shielding the user from the uglier CRU details. I just think it is not a real substitute for a full-bore memory expansion design. We have never been able to do anything with it here because our HRD-3000 has only ever fully worked for a week and currently sits on the shelf as unusable. As a consequence I am ouite turned off RAMBO as an idea to follow. The Myarc 512Kb RD was never designed as a general purpose device, as it banks all 32K expansion RAM space at once. It is a difficult device for other possible memory expansions to live with because its basic 32 Kb is out there in the PE box and cannot be turned off. Uther early third party devices are just too rare to be of interest - I have seen only one Coundation card, and no Morningstar ever seems to have crossed the Pacific. RAVE have been mentioned as another source, but have never been sighted over here.

One item on comp.sys.ti did seem to give the impression that 11's only RAM banking scheme was that developed for the 99/8. Well, never having seen a 99/8 I don't know what the

scheme was, but clearly it would NOT have been strictly relevant to the 99/4a, even if a 99/8 could interface to the the P/E box and cards in it. In fact 11 gid have RAM expansion plans for the 49/4a in a 129Kb card and further plans for an even bigger card. We have one of these rarities working (using a fl pilot batch PC board and PAL chip courtesy of Kichard Fleetwood) and I gather several other people have also. It was presumably designed with further extensions to Extended Basic and E/A in mind, and left low-mem alone while switching in 32Kb banks for high-mem, and f\*2 DSR space. It still looks to me like a very workable model for memory expansion on the 99/4a, with CRU assignments needing redoing for arbitrary size and made readable as well as writable, and a standard mapping routine established. Of course 10 years later it would be surprising if better expansion implementations were not feasible.

The arguments so hotly pursued, with no real technical detail apparent to this outsider, on merits of different memory banking schemes seem to miss the real point that the actual details of banking of data areas in any reasonably designed system are a minor factor compared to the decision overhead on whether to flip banks or not when data sets are bigger than the bank size. This is already a problem in using the 9938 VDP but is eased there by auto-incrementing of bank addresses on read or write of byte data over bank boundaries, which saves having to do comparison checks on VDP address for every byte transferred, or other prior calculations where possible. Then the mapping routine has to be called only for new addresses starting a run, and I have always found it sufficient to map from a virtual 64K buffer. which is in scale for a 16-bit CPU. As an aside, from Will's recent experience on writing production level image processing code on PCs, the greatest single cause of problems is segment handling, and Borland 16-bit compilers are very much out of favor worldwide amongst heavy duty users for this

There does not seem to be that much between different ways of controlling memory banks. The 9900 does have the CRU structure as a very efficient way of controlling on/off lines, and in the 99/4a DSR structure this makes for a robust system. It set their 128 Kb card at fixed DSR CRU base. which needs everyone to agree (none of us having II's muscle power here). A more flexible system would be a card settable to any convenient CRU base with a minimal DSR for location and identification purposes, and read/write of bank assignment via CRU bits. Then a driver routine, perhaps downloadable from the DSK, could provide all the flexibility required. Butside BSR mapping, it is still possible to use the CRU. Edgar Dohmann did this some years ago in a banked 32 Kb RAM cartridge for DataBiotics using CRU >800 as base address. Now this is where some general agreement on CRU assignment would be necessary. The general alternative method is to use a memory mapped control register. The 99/4a already does a lot of this for various purposes, though II NEXT PAGE

were very chintzy in the deriding. Presumably expansion designers can find a way to slot another device address in the gaps in >8000 to >A000 that currently go to waste. What is not good is to have memory mapped addresses intruding into previously general purpose memory areas. This is just a recipe for incompatibility and in this case prior software writers cannot be faulted for ignoring system guidelines. Even on the margins it can be a bother. For instance the HVYY Quest banked 32 Kb KAM cartridge sitting in this very machine banks with writes to the top addresses, and even this is nuisance enough to make it special purpose only.

When it comes to code segments the programmer should be in control as deeply as desired and not totally insulated. otherwise inefficient code will result even if it is easy to write. Let's face it, charming and elegant as the TMS-9900 processor may be, it is very underpowered by current standards and absolute attention to detail and good design sense is necessary to get acceptable results. I get very uneasy when I see MS-DUS and Microsoft practices being taken as a model to apply to the TI. Even mure so I get uneasy when I see Computer Science academic approval being given to an approach. Not that CS faculty don't have a whole lot of good advice to give, but efficient use of limited physical resources has rarely been a priority for them. Real users of computers do care deeply about efficiency, no matter how powerful their platform. See the book "Numerical Recipes in C, 2nd Ed" for the viewpoint of physicists and engineers as

It is clear that the CPU side of the 99/4a is already overwhelmed by the 9938 VDP in 80-col systems, and that more CPU memory would bring the system into better overall balance. It remains to be seen whether CPU performance is then in balance with the rest of the enlarged system. The beneve is very much better from this point of view.

No details let alone any hardware or software for the newer entries in the memory stakes have yet come to Newcastle. As for Funnelweb developments to use more memory - well basically I support the hardware we have available here, after making my own judgments on what is worth supporting and how heavily. As example 80-column expansions have been strongly and consistently supported, though only rather late in the piece and then courtesy of Dijit and the AVMC. If this system did not have a 9938 it would have been banished to the closet years ago, and all funnclucb development haited. In fact nowadays 9938 related developments lead, and ideas generated carried back where possible to the standard system. The Myarc HFDC on the other hand we regarded as too flawed to go overboard on (and an example where some competition from realistic alternatives might have worked wonders). If we do not have the hardware the support will of necessity be limited or nonexistent. Commercial sources often have an attitude to fairware developers that is ambivalent at best. The decision for them is whether to regard fairware writers as a only another

customer or as a resource. We respond in kind, while we still have any interest.

That is enough for now or Charlie will never get to receive this.

Tony McGovern Funnelweb Farm Jun / 14 / 93

\*\*DONE\*\*

# LETTER TO THE EDITOR FROM BRUCE HARRISON: A PD Time Calculator and an upcoming EXTENDED BASIC COMPILER!!

25 June 1993 Dear Charlie:

Me're always at work on <u>something</u>, and her's our newest offering in the Public Domain market. Like many things, this a "product" born of our own necessity. Lory was doing some taping of music from records and CDs onto cassettes so she can hear some of her favorite music in the car. As always, she ran into the problem of figuring out what would fit on a 30 or 45 minute cassette side. she works out the timings on a hand-held calculator, but that's not really a great solution, since the calculator is not equipped for handling base 60 numbers. Seeing a difficulty, I leapt to my trusty 11, and in a coule of days had a product to end her agony over adding up timings.

The product is on the enclosed disk, called TIMECAL. It's an Extended Basic program with Assembly help built in to speed up operations. As with all our products, there's a set of instructions on the disk as the D/VBO file INSTRUCTI, plus an XB program called PRINTINST to print these instructions. Thus the whole thing can be used with only the 32K, XB and one SSSD drive. So far as 1 know, this should be compatible with beneve, as well as with TI.

tive main functions are offered on the menu. include an "elapsed tin" function, a "cumulative sum" function, plus the ability to multiply and divide time quantities by ordinary numbers. For the Elapsed time function, ther's a special ability to work the problems with either a 12 or 24 hour clock. this would be a help to anybody in quebec or france, since those countries, like our military, use a 24 hour clock. (Default is 12 hours.) the Time multiply function should come in handy for people who cook (as I do) using recipes from various sources. The common problem 1 run into is that the recipe says something like: Koast at 350 degrees for 30 minutes per pound. Usually the piece of meat I'm roasting does not weigh some integer number of pounds, so I have to multiply 30 minutes by 3.78, or something like that. With TIMECAL, I can get such calculations done in very quick fashion, with results NEXT PAGE accurate to the second.

In other news, work is still proceeding on the XB Compiler. The first phase (reading a "first pass" from an XB program) is now working. This part takes an XB program saved in MERGE format and scans through that file to gather up all the line numbers and variables that appear in the program. These are saved into tables in memory, so they can be used during rass two, which will make the required Assembly source file.

The compiler is planned to work like this: You'd make your AB program work in the normal fashion first, of course, using the interpreter to write and debug the code. When all seems to be working the way you want, you'd save the program as a MEKBE (0-V163) file.

Running the compiler would take that MERGE format file and create from it two outputs: 1- an assembly source file; 2- another MERGE format file that would serve to "start up" the Assembly part from XB. After assembling the source file, you'd then use a special loader to place this D-F80 object file in high memory, then you'd merge in your new "startup" merge file. After that, you'd SAVE the resulting "XB" program in the normal fashion, and what you'd have is a compiled program that would run under XB, without the need of an E/A module. (We plan to include a special loader for Art Green's Assembler, so that all operations, including the Assembling of source file, can be done without needing the E/A module.)

This work is very tedious. Many hours have been spent just in the "research" phase to figure out how XB performs many of its operations. We had a big "leg up" from our friend Harry Wilheim, who cam up with a way around the "DSKLNK" delemma. Harry devised and gave us a way of "faking" lines of XB code within the Assembly part of the program, so that operations like Opening, Reading, Writing, and Closing files can be terformed for us by the Interpreter. Harry's unique and very clever method allows XB to perform these steps, then return control to our Assembly code right where we "left off" when we invoked the "fake" XB code.

Of course a huge amount of work is still ahead of us, but this project has made great strides since may 15. Just being able to find and store all the variables from the XB program required many hours of work. The biggest trick was not to duplicate the variable names each time they occur in the "source" DVI63 file. thus, each time we encounter a variable name, we have to run through the list of what we've already found to make sure this one isn't already there before adding it to the list. Even so, the compiler's first pass takes much less time than XB takes to merge the file into memory, so we are encouraged to continue.

There Will be a couple of limitations on the content of the XB program that we start with, the biggest of these is that no "User Defined" sub-programs can be handled. This may change in Version 7.xx of the Compiler, but certainly user sub-programs will not be handled by Version 1.00 of the Compiler. (In our own work, we never use the sub-program concept, because it slows down operations terribly, and eats memory by the ton for no good reason.)

The enclosed disk may be added to the User Group Library, placed on BBS, or whatever else you desire, provided only that the whole disk is included in any copies distributed. We look forward to seeing you at Chicago this fall. Perhaps we'll have Version 1.00 of the Compiler ready for the TI "Public Domain" market.

Best Regards. Bruce Harrison 5/05 40th Place, Hayattsville MD 20781 301-2//-3467

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## POWER YOUR ENTIRE II SYSTEM ALMOST ANYWHERE WITH AN INVERTER

by Charles Good Lima Ohio User Group

In the June, July, and August 1989 issues of Micropendium Jan Janowski had a series of articles describing how to run a small Il system in the field powered by a small 12 volt battery. (The articles originally appeared in the Chicago Uaer Group newsletter.) Jan's "portable II" included 32K, PID port, and a ramdisk all in the console. There were no disk drives. All this required much complicated custom wiring and soldering. There is an easier way. With NO MODIFICATIONS WHATSOEVEK you can run your entire II system (console, PE box full of cards and two floppy drives, small monitor, and maybe also your printer) for between 30 minutes and several hours powered by a 12 volt automobile or (better) deep cycle battery. All you need is an appropriate inverter!

Inverters convert 12V DC current into 117V 60 cycle AC current. Any AC product can be run from a 12V DC power source such as a battery with a modern inverter. Inverter technology has improved considerably in the last 10 years. Uld style inverters were very inefficient (50-60%) and produced "square wave" AC which is unacceptable to most electronic devices such as TVs stereos, and computers. Modern inverters produce "modified sine wave" AC which is acceptable to almost everything electronic including T199/4A equipment. One manufacturer now offers a true sine wave inverter said to be compatible with the most sensitive electronic equipment. These modern modified sine wave and full sine wave inverters are 80-98% efficient and deam only very small amounts of power when on standby.

The STATPOWER PROWATT 250 is a 90% efficient modified sine wave inverter will power a complete T199/4A system from a pattery if you use a small monitor such as a 4" B&W TV. The STATPOWER 250 will deliver the following AC current: 500 watt surge, 300 watts for 10 minutes, 250 watts for 30 minutes, and 200 watts continuously. Output voltage is very well regulated at 60 cycle and 115V +- 5% until automatic shutdown if the battery voltage gets down to 10V. This is better voltage regulation than the power company provides! Just plug in a multiple plug power strip into the single female 3 hole outlet at the AC end of the inverter, and plug the 1177/4A components into the power strip. You can run a console (40 watts), a full PE box (150 watts), and a 4 inch BWW IV (16 watts) on the STATPUWER 250 powered by a car battery. I have done so. Run time is is at least 30 minutes and may be greatly extended if you have a "switching power supply" in the console or if your small TV doesn't need the inverter because it can be run directly from a 12 yolt source. (My small IV draws 16 watts AC from its inefficient (always warm) AC transformer, but draws only 9.5 watts when powered directly from a 12 volt battery). The main limit to run time is the power stored in the battery. If you use a 100 amp hour deep cycle battery (commonly available at

department stores like Sears, Walmart, and Myers) where electric fishing "trolling" boat motors are sold), you can run all the above computer equipment for over 4 hours without discharging the hattery more than 80%. Unlike automobile starting batteries, deep cycle batteries are designed to accept 80% discharges repeatedly (200+ times) with no significant loss of battery performance.

The STATPOWER 250 has a cigarette lighter plug and can be pluged into a car's digarette lighter. However, most automobile lighter plugs are fused at 10 amps DC, which means a maximum of 120 watts of power is available from this source. To run a PE box equipped 99/4A you need to cable the STATPOWER 250 directly to a battery. The necessary 1 foot cable for car battery use with clamps for the + and - battery terminals on one end and a female digarette lighter plug at the other end is available from Radio Shack. WalMart, and many auto supply stores.

As of early August 1993 catalog prices for the STATPOWER 250 vary from \$198-\$229 plus shipping. It is available from KEAL GUUDS (phone 800-762-7325) or SUNELCO 800-338-6844). Phone these dealers and ask for catalogs. They both sell inverters of larger and smaller capacity and both dealers can also set you up with a solar panel to charge the deep cycle battery you will use to power your II system at remote locations. Smaller STATPOWER inverters not powerful enough to run a full II system have recently appeared in the C.O.M.B. catalog. These smaller inverters can be used to run small AC electrical devices from a car's digarette lighter. 140 watt AC continuous, item P3522-9506, for \$70. 125 watt AC continuous, item v3661-9505, for \$70. 50 watt AC continuous, item v3662-9505. for \$50. C.U.M.B.'s phone is 800-328-0609.

### ProWatt 250-Watt Inverter



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### RUM YOUR COMPUTER AND OTHER HOUSEHOLD DEVICES ON CLEAN DEPENDABLE SOLAR POWER.

by Charles Good Lima Ohio User Group

With the recent development of inexpensive efficient sine wave (or near sine wave) inverters it is now possible to power all the AC electric appliances in your house including our 99/4A computer systems using a DC power source. The most elegant and environmentally friendly source of DC electricity is a photovoltaic panel, the sort of thing that allows light to power many of today's calculators. I have a TI99/4A computer system running completely on solar power, and my CC40 computers run on NiCad batteries that are charged with solar battery chargers. This is the environmental thing to do! For a few \$100 you can run a fully expanded 99/4A system with solar power. For an investment of about \$11000 you can disconnect your home from the power grid and generate all your home's electricity requirements from the sun. Once the initial investment is made in photovoltaic panels, these devices continue to produce "free" electricity basically torever. Unlike a lot of other solid state electronic devices, most photovoltaic panels do not wear out.

Conventional sources of electric generation are bad for the environment. Electricity made from fossil fuels consumes non renewable resources and produces lots of pollution (soot. sulfur dioxide, nitrous oxides) that causes smoo, acid rain, and health problems. Carbon dioxide, which is what you get from an absolutely "clean" burning of anything, is said to be a major factor in the planet's gradual warming trend (global warming). Carbon dioxide produced by the burning of fossil fuels is a major source of the increasing percent of carbon dioxide in the earth's atmosphere that has been noted over the last several decades. Electricity generated from nuclear power produces no carbon dioxide, but the potential dangers of nuclear power are enromous as evidenced by what happened at Chernobyl. Also, we still havn't figured out what to do with the high level radioactive waste from nuclear power plants, waste that remains hideously lethal for thousands of years.

The electric bill you pay every month pays for the power company's naroware and for the fuel the power company consumes. As the years go by you can expect these fuel and hardware costs to increase and your electric bill to also increase. WHAT YOU DUN'T PAY FUR with your electric bill are some direct and numerous indirect costs related to electrical generation. Nuclear generated electricity has direct costs that our children and many generations of grandchildren will have to pay. Nuclear power plants gradually become so radioactive that routine maintenance becomes impossible, at which point they have to be permanently shut down. They usually cannot just be disassembled and carried away because of this radioactivity. The reactor core must remain in place and be be monitored, maintained, and patroled with secutity guards for a couple of hundred years. In almost all cases

electric utilities that own these nuclear power plants plan to pay for these "decommission" costs from their current rate base (ie. our children). Then there are the perpetual costs of monitoring high level nuclear wastes and keeping these wastes out of the environment for thousands of years.

There are lots of indirect costs associated with making electricity from traditional fuels. What is the military cost of keeping the Persian Gulf open and the oil flowing our way? How about the cost of the rot to buildings, cars, and people's lungs caused by the pollution of coal generated electricity? What is the dollar cost of environmental damage due to oil spills, coal mine waste piles, forests and lakes killed by acid rain, and reduced crop yields due to acid rain? I am a chromic asthmatic and spend hundreds of dollars every year on drugs to keep my problem under control. I will have to do this for the rest of my life. I know that for myself foul air means a greater chance of an asthma attack, more drug use to control these attacks, and very occasionally an overnight stay in the hospital if the drugs don't work. How many cancers are caused from nuclear waste and nuclear power plant accidents? How many extra billions of dollars are spent annually on health care and how many work days are lost due to pollution from electrical generalium? How do you put a price on beauty? What is it worth to see the North rim of the Grand Canyon from the tourist facilities on the South rim? Often this is difficult because of the haze produced by a coal fired electric generation plant 50 miles away. It is difficult to quantify these indirect costs associated with the usual methods of generating the electricity you use, but I suspect they add up to several times the cost the country's monthly "electric bill".

Electricity generated with photovoltaic panels is virtually pollution free! There are no poisonous gasses or green house gasses (ie no carbon dioxide), no radioactive waste or danger, and no consumption of non renewable fuel resources. Several tens of thousands of private homes in this country are "off the grid" and generate all their electricity from solar. These households have NO MONTHLY ELECTRIC BILL to pay. The only continuing expense for such "off the grid" homes is replacing batteries every 10-15 years. Many electric utilities charge \$10 per foot to bring power to loctions not within easy reach of an existing power line. For homes more than 1/4 - 1/2 mile from the nearest power pole it is often cheaper to stay off the grid and purchase the solar equipment needed to make all their own power than it is to pay the power company to extend their electric lines to your home. The exact break even point varies from one electric utility to another. For locations near a power line simple calculations suggest that it is cheaper to use the power company's power than to invest in solar electricity, but that is only because these calculations do not take into account the indirect costs outlined above.

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Photovoltaic panels are based on silicon, mainly obtained from common quartz sand. Silicon is a resource we are not likely to exhaust since it is one of the most common types of atoms found in the earth's crust. Panels consist of a number of silicon crystal or amorphous silicon photo cells wired to produce enough voltage (usually about 16 volts) when the sun shines on the cells to charge a 12 volt battery system. These cells are all sealed from the elements within the panel. Lower voltage panels are available. Higher voltages can be obtained by wiring several panels in series. Unlimited increases in power (more watts) can be obtained by wiring additional solar panels together in parallel. The modularity of solar panels makes them attractive to small power users or those with limited funds who are interested in a little energy independence. The single solar panel on my roof is identical to those used by large scale utility owned solar electricity generating facilities in California. They have 1000's of panels, I have only one. When money is available it will be easy for me to add more solar panels to my existing small scale home solar electric generating system.

The first experimental silicon crystal photovoltaic panels were made in the middle 1950's. Panels manufactured in the late 50's are still in use and are still producing almost as much electricity as they did when they were new. The power (watts) of solar panels decreases a little during their first couple of years of operation due to a darkening of the panel's coating. After that, power output does not continue to deteriorate. Apparently THESE DEVICES DO NOT WEAK UU! The failure rate of existing silicon crystal photovoltaic panels is less than 2 per 10000 panels per year.

In the 1980's production techniques began to improve and manufacturing costs decreased. Because of the increased volume of photovoltaic sales and continued manufacturing efficiencies, costs of photovoltaic panels continue to come down. It is now possible for ordinary consumers such as ourselves to purchase new photovoltaic panels for as little as \$6 a peak watt in small quantities (\$449 for one new 75 watt panel). Used panels (they don't wear out) cost even less. Manufacturers offer amazing warranties of 10, 12, or 20 years on new panels, quaranteeing the panel will produce at least 80% of its rated power for at least that length of time. A peak watt is the power output of the panel near the middle of the day when the sun is at its brightest. Dhio averages 3.9 "peak" hours of sun per day. The rest of the contenental U.S.A. averages between 3.5 and 5.0 peak sun hours per day. These are annual averages and take into consideration average cloud cover and seasonal day length variation. Solar panels will continue to produce electricity at their rated voltage when the sun is low in the sky or when there is a cloud cover, but power (watt) output will be less than "peak".

What can you do with electricity made with solar power. After all, the power output of solar panels is not

You get no power at night and reduced power if continuous. there is less than "peak" sun. One alternative is to store the electricity in lead acid batteries. This is what "off the orid" home owners do. Solar panels will last more or less forever, but unfortunately batteries won't. The best batteries available to "off the grid" home owners have to be replaced every 15 years. Battery replacement is the only recurring expense of remote solar electric systems. alternative is to sell your solar electricity to the local power utility, and then buy it back as needed (at night for example). The power company acts as your battery, storing your electricity for later use. Laws require that electric utilities purchase power from small private producers. There are three disadvantages to selling power to your local electric company. 1- You have to pay for an expensive "synchronous inverter" interconnect which will turn your solar DC electricity into 60 cycle AC current that is EXACTLY synchronized with the 60 cycle power company current. 2- If there is a power company power failure your own generating system is also automatically shut down by the synchronous inverter interconnect. The power company doesn't want its power lines energized while the repair crew is trying to fix things. Thus, an interconnected small private electricity source CANNOT be used as backup electricity. 3- In most states the power company is allowed to pay you LESS per kilowatt hour for your electricity then you have to pay the power company for its electricity.

I have a miniature 99/4A computer system (99/4A console, tape recorder, hexbus interface, hexbus printer plotter, wafertape drive, small B&W TV for use as a monitor), an 18 watt fluorescent light and a shortwave radio receiver all (except the TV which runs directly off of a 12 volt source) powered by an inverter connected to a 115 amp hour deep cycle 12 volt battery. The battery is charged with a 27 watt solar panel occupying less than a square yard on my roof. I purchased this panel new with a 12 year warranty for about \$200 including shipping (\$7 per peak watt). Total power draw of all these devices (taking into account the 90% efficiency of my inverter) is 80 matts from the hattery. I can run ALL this stuff simultaneously for 13 hours and not dangerously discharge my battery. For every hour I run all these devices simultaneously (usually I don't run them all at once) it takes my 27 watt solar panel 5 peak hours to recharge the battery. This takes into consideration the fact that you have to pump into a battery 125% of the electricity you get out of the battery. If I had a fully expanded 99/4A system with a peripheral expansion box hooked up to this battery. I would want a second solar panel to speed up battery recharge time. I expect soon to purchase some additional solar panels. There lots of square yards left on my roof.

I also have a variety of solar powered nicad battery chargers which I use to charge batteries for use in  $\,$  my CC40 computer, II-74 computer, and  $\,$  my hexbus peripherals. The charger I use for the  $\,$  4 AA batteries I put in  $\,$  my CC40

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computer is about the size of a cigarette package. It fully recharges 4 AA nicad batteries in 14 hours of "peak" sun: I keep this charger in a sunny window with a set of batteries inside, and another set of charged nicads in my CC40.

I purchased all my solar equipment from REAL 600DS of Ukiah CA. (The company name and my last name are the same only by coincidence. I am however, impressed enough with the company and its products that I purchased \$90 worth of their common stock.) They are this country's largest retailer of solar electric panels and other products for "off the grid" homes. Another large retailer of solar panels and related products is SUNELCO of Hamilton Montana.

A quote from the REAL 60005 "Alternative Energy Sourcebook" gives you an idea of what is possible with a solar electric home. For \$10700 the company will sell you its "Memore Home Kit 4". This includes everything you need; solar panels, mounting hardware, batteries, inverter, fused load center, safety disconnect, meters and other equipment all U.L. listed and all in compliance with the current National Electrical Code.

"In the world of photovoltaic home systems, this is a giant. It will power a large energy efficient nome with all the comfort and convenience of a city home hooked to the power grid....Use your vacuum cleaner, washing machine, microwave oven, entertainment equipment and computers with the confidence that you have a substantial energy system composed of the best components available."

It is assumed that such an all solar electric energy efficient home will use only fluorescent tubes or compact fluorescent light buibs for lighting and will not use electric resistance for space heating, clothes drying, and water heating. Alternative sources of energy such as direct solar water heating, propane, wood, and a clothes line are available for these purposes. The "Remote Home Kit 4" produces 4600 watt hours per day with 5 peak hours of sun. You can always get more electricity by adding more solar banels.

According to the Electric Power Research Institute in California, "25 percent of today's U.S. electricity needs could be met by solar cells deployed over an area of less than 8 percent of the area used by the U.S. military." Lots of military bases are scheduled for scaling down or closure in the next few years. I wonder what will happen to all that land?

l believe solar electricity will be a BI6 part of the planet's energy future. Electric utilities in California are now actively investing in large solar electric power plants. In the near future I envision many utility owned solar power plants. They are now cheaper to build and simpler to operate than nuclear power plants and can be used to meet peak daytime industrial and air conditioning electric demands. I also envision solar panels on the roofs of factories, office and apartment buildings, and private homes interconnected to

the local power grid and I envision lots of "off the grid" solar electric systems bringing electric power to all corners of the planet while producing electricity without stinky poisonous exhaust, radiation, or greenhouse gasses.

If all this sounds interesting call either of the companies below and ask for their catalogs. SUNELCO has a very extensive informative 123 page catalog. REAL GOODS has a free color catalog and publishes the "1993 Alternative Energy Sourcebook", the most complete single source of information there is on this topic and the source of much of the information in this article. The cost of this 518 page book is fully refunded with the purchase of \$100 worth of KEAL 6000S goods.

KEAL 60005 966 Mazzoni St. Ukian CA 95482-3471 Phone 800-762-7325

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#### APPLE REINVENTS THE WHEEL

From the Thursday July 29, 1993 LIMA NEWS:

"Apple computer Inc. of Cupertine Calif., plans to introduce a new fine of mid-priced Macintoish personal computers Thursday that talk, recognize voice commands and read text. The Macintosh Centris 660AV and Quadra 840AV PC line will be available next month."

Charles Good's comment on the above;

Our 1983 1199/4A computers can talk. I published an Extended Basic program in the November 1992 issue of the Lima newsletter that loads II's public domain Text-to-Speech and then lets the 99/4A read any DVBO text file. If you have the MBX system, reviewed by me in the December 1990 Lima newsletter and recently republished by the Toronto user group, your 99/4A computer can recognize voice commands.

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#### UPDATED/CORRECTED FUNNELWEB VS EDITORS

The Funnelweb v5 40 column editor is being mailed with this newsletter. Those who we think can use it are also getting the 80 column editor. If you don't get the 80 column editor with this mailing and want it, send \$1 to the newsletter address and we will mail it right out to you. These editors supersede all previous releases of the v5 40 and 80 column editors (including those sent directly by Tony Mcbovern) mailed prior to the third week of July 1993.

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