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PEOPLE'S COMPUTER COMPANY

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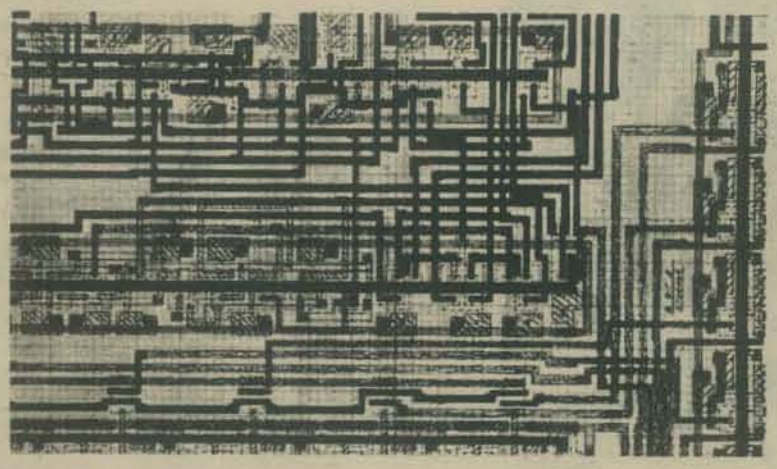
INTEL 8080 CHIP

CHIPTALK:

This year's miracle PACE

Not too long ago it became possible for large scale chips to be made. Intel rolled the ball with the 8008, then rolled it some more with the 8080. This year's real winner looks like being the PACE chip, from National Semiconductor. These things are not easy to make. The difficulty of making them is enormously increased as they get bigger, and a 16 bit CPU is awful big.

The story starts with a few enthusiasts, a blackboard and a whole crew who doubted it could be made at all. Moby chip, as it was known, was not a project for the faint hearted.



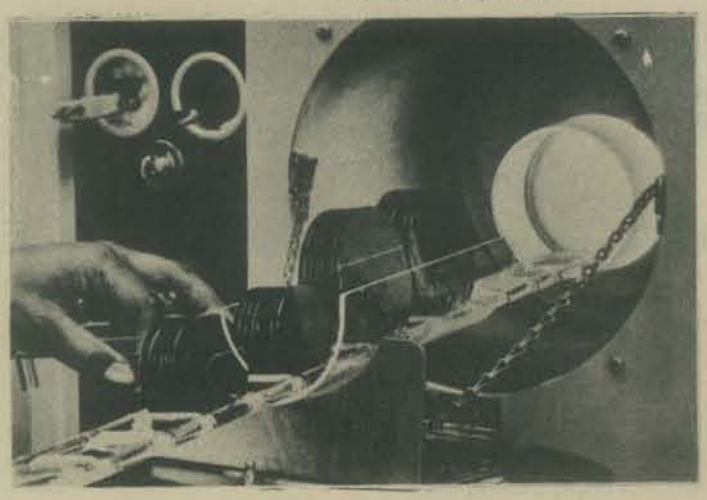
The crooked lines on the blackboard soon became straight and well defined. Very. This is the beginning of the marks which optically define the position of every tiny facet of the chip to be. The precision of the whole process starts here, and here also is the place where chips can be designed not to work – every line is checked and rechecked and ...

Sometimes a particular person can make things when others can't. There is the tale of the big manufacturer which was licensing a company in another country to second source its product. They set up a production line and taught the other company to run it. Products were excellent but somehow the deal went sour and the men from the big company went home. And the production stopped - nobody in the other company *could manage* to make them any more.

Sometimes it is literally a single person. Some years back a company was trying to make about 500 transistors. They had to handle 1,000volts, so it wasn't easy. Out of each batch, they were lucky to get two which worked and they were losing there
and they were losing their shirt until they noticed that one employee, on the night shift, was making far more than all the others combined. But when they watched her, she did no better than anyone else. The mystery was not cleared up until someone who she knew was watching her work and chatting, very late one night. She was loading a batch into the oven and , rather tentatively, remarked that she usually smoked a cigarette about that time. She was told to go ahead, just do everything the way she usually did when when she was alone. Semiconductors are processed in clean clean rooms, so that was like a surgeon smoking over his patient, but the batch turned out fine. Later experiments showed that tobacco smoke upped the yield for other employees, but not by very much and they never figured out why, so she eventually made the entire 500 units.

Now the magic begins. It starts with a single crystal of pure silicon. PURE silicon. The chip is made by making parts of of it very slightly impure – if there are impurities already in the silicon, nothing will work. (Repeatedly chalk *sodium* on the sidewalk outside a semi-conductor house and you are likely to cause people to have nervous breakdowns.)

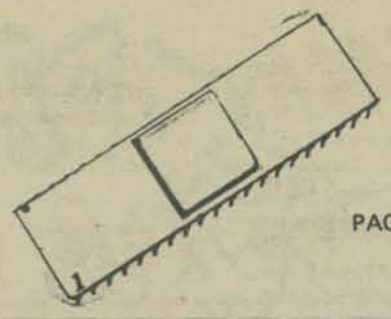
The silicon is sliced into wafers, the wafers are ground optically flat, cleansed of scars and cracks, and then processed. By etching, cooking , defusing and oxidising. Bear in mind that we are discussing an item so delicate that a human hair looks like a tree trunk beside it. Yet, this thing gets cooked in an oven. Repeatedly. This really is the time for the good fairy to come along and wave her wand, though black magic describes the process better than science. Science there is, for instance, each mask step requires alignment. Precise alignment, for any error will place things where they should not be, and the things to be placed are very, very small. And there are many masks.



Magic there is too. Sometimes the process works without trouble. Sometimes the process is completely lost after working perfectly for months, and if it can't be found again, the product is dropped. This happened to one of the larger, and better makers. They were making a device which, for this article, we will call a 2N4249. They then made an improved version, the 2N4250. This was fine in the lab. Fine in pre-production. But they forgot how to make it, struggled and struggled to remember, couldn't and quit making them!

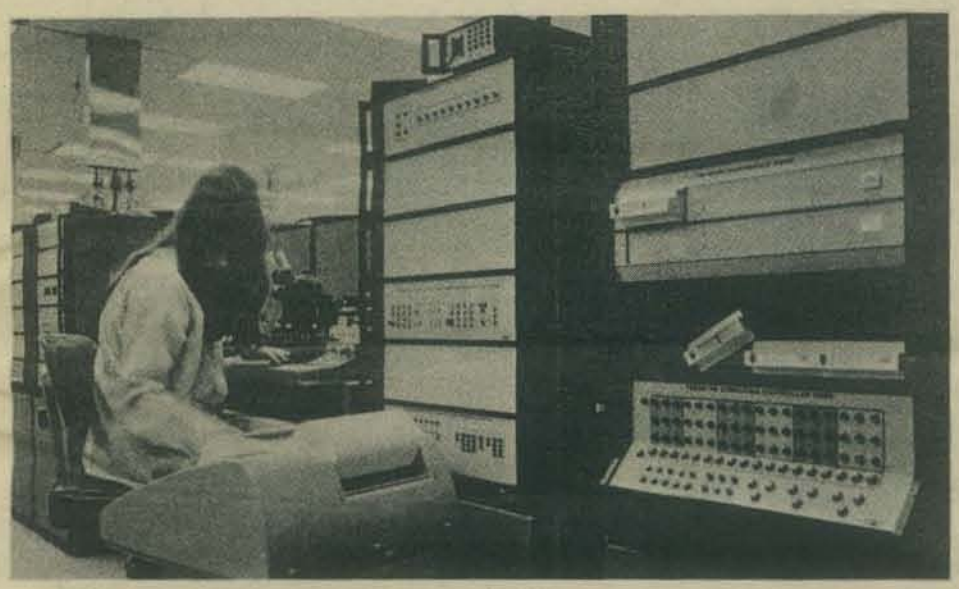
If the process could be really defined, the devices could be reliably produced, but it is far too complex. In reality it is much akin to cooking - one ounce of this, a teaspoon of that, a pinch of the other, then cook until it is just ready for something else. When is it ready? Well, a good cook just knows . . . . The analogy goes further - if you want a good meal, go to a restaurant with a good reputation. And if you like to eat at the little place on the corner which has those super exotic dishes, better hope they keep their kitchen clean.....

After surviving all this brutal treatment, the wafer is broken into pieces. Even Moby chip can be made many times on a single wafer. Now comes the job of mounting the final chip, the survivors that is; obvious bad ones being culled. The chip is placed gently and carefully into its final position, and then the connecting wires are welded on. Yes – welded – the final brutality.



PACE chip - actual size

The girls who do this work are careful – but a few more chips bite the dust here. Leaving the survivors to go to testing..



The main testing machine costs $250,000 which is one reason why the amateur can't effectively do it, even though he has more time to work. Even National can't test for everything and it isn't just the money. Moby chip has a possible 337 instructions. To test for every possible combination requires 337 factorial tests – and this does not include the possible patterns in the registers. Humans do not live long enough to exhaustively test items of much complexity. Even with millions in everyday use, some errors may never be found. Someone testing an 8080 recently reported to the Homebrew club that if it was given an interrupt on one particular clock pulse of one particular instruction, it jumped to location zero. But the fault vanished if the chip was clocked 5% slower.

Another complication comes about because the testing does not separate chips into good chips and bad chips. This cannot be done for the same reason that one cannot separate pies into good pies and bad pies. The best pies are superb. The worst inedible. All the cook can do is to draw an imaginary line, throw out all those on one side and sell the others. Knowing of course, that his reputation as a cook depends on the flavor of the pies.

If he is a good cook, he doesn't throw many pies away and prospers. If not he goes under. The word for this is yield, and a 70% yield, less than one third thrown away, is remarkably good. A 5% yield will close out a product. The cost of making a batch is identical whether it is good or bad, and the cost must be recouped from the sale price.

GODBOUT™
BILL GODBOUT ELECTRONICS
BOX 2355, OAKLAND AIRPORT, CA 94614

Bill Godbout has picked the winners of the PCC Competition. They are:

1st Larry Pleskac – PACE CHIP

2nd ? – 8080 CHIP

3rd J. Aldridge – 8008 CHIP

You may be wondering what the name of the second place winner is. So are we. The winner forgot to sign his name. The entry was written on plain lined paper, sent in a company envelope, and was the only one that was. If the winner will identify the name of the company, and himself we will see to it that he receives his 8080 chip.

NATIONAL SEMICONDUCTOR

PACE was not easy to make. Moby chip has come of age though, and is beginning to pour out from National. Quite a few are pouring onto Bill Godbout's desk - the beginnings of a torrent, to judge from what we have seen of his kit.

Bill, by the way, recently bought a lot of 4K EROMs He sells them cheap, programs them for the buyer and has an 8K Altair board to suit them. A lot of them were ordered by a company which was going to sell them with an assembler for the Altair, they cancelled and so he has around 200 of his 8K boards, with 4K of EROM containing the assembler to sell.

DRAGON SMOKE

Remember your first birthday?
Maybe the cake looked like this

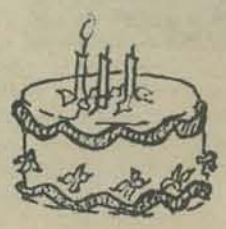
Well, on your second birthday there were 2 candles, on your third birthday 3 candles, and so on. As we grow older, the number of candles gets embarrassingly large and harder to blow out.

Sooo . . . why not try a binary birthday cake?

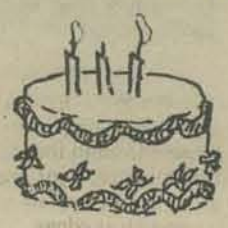
ONE YEAR OLD

TWO YEARS OLD

THREE YEARS OLD



FOUR YEARS OLD



FIVE

SIX

SEVEN

and so on. With 4 candles, we can go up to 15 years old, with 5 candles, up to 31 years old and with 6 candles, up to 63.

39 YEARS OLD

58 YEARS OLD

But if you are 58, get people to look at the cake from the back instead of the front . . . in fact, if you don't put something on the cake to indicate the front, your age will be ambiguous (unless, of course, it is a binary *palindrome*!).

A PALINDROME!

How many candles would Methuselah need?
How many candles would Gandalf need?
How many candles would a Dragon need?

And, for all you computer people out there –

Here is a cake with an extra BYTE

How Do You Spell PEEPEL?

Look it up in the *New Phonetic Spelling Dictionary* by Behzad Kasravi. First, remove the vowels, then look up PPL and find

P P L	People	Aha! Here it is.
P P L	Papilla	
P P L	Pupil	

In other words, this is a phonetic spelling dictionary that goes strictly by the pronounced sounds of the *consonants* of words.

Interested? Go to the source.

Behzad Kasravi
INTERBOND
P. O. Box 5566
Santa Barbara, Ca.
93108
(805)962-9905

The following article is adapted from sections of the narration in filmmaker/domebuilder Jerry Brown's DOME FILM. Jerry is also vice-president of Dymax and coauthor of BASIC, the programmed instruction text published by Wiley & Sons.

Geodesic domes have enjoyed a sort of fadish popularity in the last decade. Because it can be shown mathematically that domes enclose a maximum of volume with a minimum of surface area, everybody thought they would be economical of building materials and therefore ecological. And they might be, if you're working on the scale of doming over whole cities. But on a people-size scale, such as cabins, houses community gathering places, or workshops and the like, well, the theoretical benefits tend to be offset by real life considerations. For example, if you're using lumber in your construction, the way lumber is milled and shaped makes it hard to use economically in the dome part of a dome house, where right (90 degree) angles don't exist. "Everything customized" is a lament of domebuilders, and if you aren't into hand-crafted houses, domes aren't for you.

Domes do have some things going for them. They can be made in modules for portable shelter, such as dome tents, even circus or carnival big tops. You can prefabricate the framework and other parts of a dome, which is efficient if it's done accurately. But mostly domes are popular for aesthetic reasons, and for the subjective good feelings of being in a round, high-ceiling, non-claustrophobic space. Geodesic domes are developed from the same set of very basic geometric (Platonic) solids that includes the pyramid, and for many people domes have the same sort of fairly mystical good energy vibes that pyramids are supposed to have.

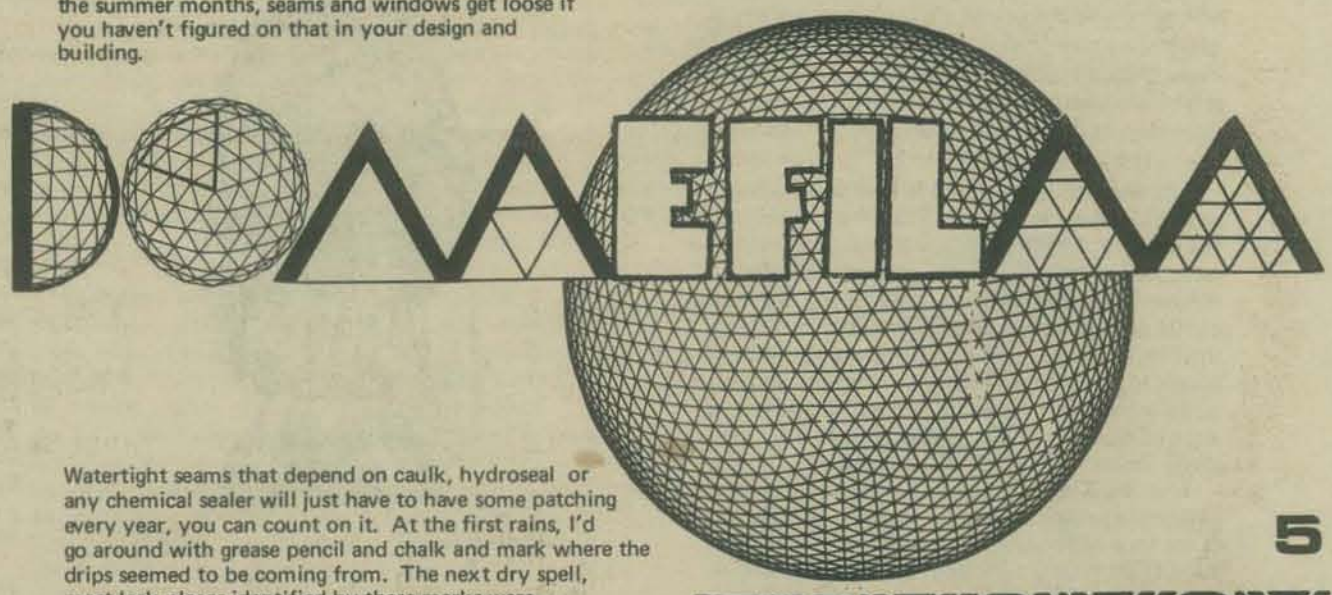
A lot of experiments in domebuilding were done at Pacific High School in the Santa Cruz Mountains of California in the late '60's, and this is where the classic *DOMEBOOK II* was put together. When Pacific decided to go residential/communal, a crash program of dome construction started. The adults and kids at PHS did about 15 domes, trying out various designs, materials and construction techniques. Those domes and the ones in the Dome Film are spinoffs of Buckminster Fuller's work in geodesic geometry. You could say that Fuller opened the mathematical door, then he patented and publicized some of the possibilities, and Bucky could be called the person most responsible for wide-spread experiments in dome building.

There is a problem with most owner-built domes: they leak. In fact I've never met a dome that didn't leak – at least a little at the beginning of a rainy season. There are three reasons for this: poor design, poor construction, and poor maintenance. A dome is all roof and little or no wall. In a regular rectilinear (squarish) building you have eaves overhanging the walls and vertical windows helping block the rain, but in a dome all the windows are like skylights, and they have to be installed and sealed like skylights. Also the fact that window installation comes somewhat late in the construction process, when people start to get blown out, doesn't help the problem. And after all the drying, warping, expansion and contraction of the summer months, seams and windows get loose if you haven't figured on that in your design and building.

Watertight seams that depend on caulk, hydroseal or any chemical sealer will just have to have some patching every year, you can count on it. At the first rains, I'd go around with grease pencil and chalk and mark where the drips seemed to be coming from. The next dry spell, most leak places identified by these marks were visually obvious on the outside. When I lived in the Sun Dome at Pacific High one fall and winter, I got flooded out on the first rain. That dome has pre-fab triangles of aluminum sheets with wood-strut edges, with adjacent edges of triangles bolted together, with a neoprene rubber "gasket" between the wood. Nobody had tightened these bolts since the dome had been put together several years earlier. There were hundreds of bolts; I felt like Chaplin in "Modern Times". But there were only two minor leaks to deal with after the next rain.

You *can* build your own dome. If you are inexperienced in construction, start modest, on greenhouses or sheds for practice. With patience, foresight and planning you can build a sturdy, tight dome that will keep you warm and dry, a handcrafted nest in the woods.

There were two big personal benefits to me from working on this project. One is the feeling in my hands and heart that I can build my own good, sturdy house, dome or otherwise, and that is a good feeling. The second is the ability to see and understand how almost any structure is built, with some judgment as to its condition and sturdiness.



The introductory section of the DOME FILM includes an outstanding nontechnical presentation of the basic geometry from which geodesic domes are derived, using a combination of computer animation, models and real structures. The computer graphics were filmed directly from a CRT display on Tri-X Reversal film at 12 fps, using a PDP-10 implemented program in LISP by Bruce Baumgart.

About Jerry Brown's DOME FILM: The Sales Pitch

For rental or purchase information, contact J. Brown, 1682 Indian Valley Road, Novato, CA. 94947.

Jerry Brown's DOME FILM is a new 16mm color sound film designed to give a practical overview of hand-crafted dome-homes of geodesic derivation. The film is an honest and objective assessment of the possibilities and uses of the dome, as well as the limitations and problems of this unusual structure. The DOME FILM is valuable in learning carpentry, construction and design, and is of special interest to those considering building their own dome, whether for a cabin, a home, a workshop or studio, a greenhouse, an auditorium, a community meeting place, a church, or to house a business (all popular uses of domes).

The introduction provides an overview of owner-built domes, a nontechnical presentation of dome vocabulary, and the basic geometric ideas from which domes were developed by Bucky Fuller and others. A dozen inexpensive domes of varied design and materials are reviewed. The introductory section concludes with an examination of waterproofing, as reducing the risks of leaks is a major building consideration.

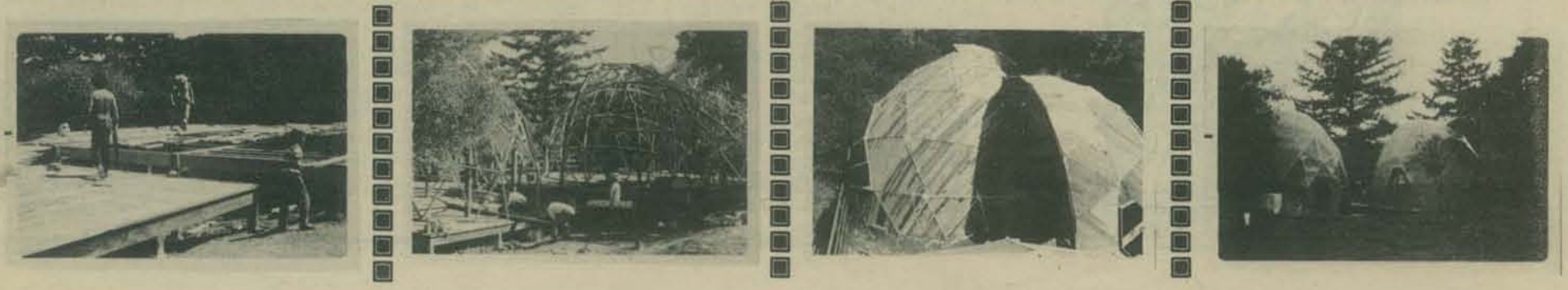
Part two of the DOME FILM, on the steps in dome construction, follows two projects in some detail from foundations to finish (see the stills from the DOME FILM below).

As a model of what an instructional documentary film should be, the DOME FILM is earthy, humorous, honest and highly informative. It features some outstanding color cinematography, an excellent original music sound track mixed from quad and 8-track studio masters, and an honest, no nonsense narration by domebuilders Joe, Robin, Jerry and Peter. They explain the problems encountered before, during and after construction, as well as the solutions they found. More than a "how-to-do-it" film on building domes, the DOME FILM also captures the energy, hopes and values of young people living in touch with the land and literally building alternatives for themselves.

The DOME FILM shows Joe, age 22, and Robin, 19, constructing a well-built two-story dome house, using $5000 in materials. Note the two 8-sided radial platforms, giving them a lower story room with vertical walls, on which sits the second story, a 30' 4-frequency alternate breakdown dome hemisphere. There is also a sleeping loft inside the dome.

The lower story is not visible in the last photo, being obscured by the sun deck or porch that extends from the edge of the dome (the second story) out to the hillside on which the dome was built.

Below: Peter Calthorpe's Split Elliptical Domes are a $30,000 extravaganza. His design features 5 half-domes fit together to form two separate houses on an adjoining platform. The split sections are supported by structural steel arches to compensate for the loss of structural integrity caused by the vertical truncation or splitting of the domes. The tall elliptical shape allows for second story bedrooms in some sections.



KINGDOM

This is the story of a computer game called KINGDOM, which like many other computer games, is based on the premise that there are a lot of things the average person would like to do, but, for some reason or another, cannot. To satisfy these urges, there are games through which it is possible to land a spaceship on the moon, quarterback a football team, beat the house at the Las Vegas blackjack table, or indulge in any number of similar activities. The game of KINGDOM adds one more item to this list which seemingly appeals to everyone: it lets you rule the world.

Just why everybody seems to have this compulsion to rule the world is still one of nature's great mysteries, but when the KINGDOM game was created during the latter part of 1972, it soon became apparent that everyone who got to play the game turned out to have a little Alexander the Great (or, in some cases, Ivan the Terrible) hiding inside them somewhere. Allowing people to play a game which gave them a chance at ruling the *whole world* has a truly amazing effect on some of them; but this is getting a bit ahead of the story. Better to start with the game itself.

What the KINGDOM game is, in effect, is a computerized simulation of a very simple economic system, in the form of a game. The overall premise of the KINGDOM game is that the player, with the help of the computer, is put in charge of a small, mythical, and somewhat medieval kingdom. As the ruler of this kingdom and its inhabitants, the player is expected to make certain decisions which will affect the welfare of the kingdom. If the player is good at it, the kingdom will survive and prosper; if the player is *very* good, the kingdom may eventually expand into a worldwide empire.

The reason for choosing a medieval kingdom as opposed to the United States of Industrialized Russia, for example, is to keep the rules of the game simple enough to be understandable (and if you have looked at the state of the US economy lately, you may realize how terribly complex the 'rules' can get, and the kind of terrible mess you can get into by not totally understanding them!). The ruler of KINGDOM does not have to worry about Urban Development, Defense Spending, Prohibition, Internal Revenue or the Garbage Strike; he has only to keep the subjects of the kindgom fed enough to prevent mass starvation and, hopefully, turn a profit while doing so.

The prime means of support for the populace in KINGDOM is agriculture; the people plant grain at the beginning of each year, harvest it at the end, and survive by consuming it throughout. At harvest time, the harvested grain is delivered to the Royal Granary, where it is put into storage. The court Scribe (in this case, the computer) is responsible for keeping track of such things, and immediately after the harvest, presents the ruler with a complete report on the resources of the kingdom, including the size of the harvest, the amount currently in storage, the acreage of land in the kingdom, and a complete census of the population: how many subjects are present, how many were added during the last year, how many were lost.

With this information, it is now the duty of the ruler to decide how much of the grain is to be distributed for food during the upcoming year, how much to be used for seed, and so forth. Grain also serves a medium of exchange; the ruler has the option of using some of his grain to buy land and expand the size of his kingdom, or conversely, sell some of his holdings in exchange for grain. Since the price of land varies from one year to the next, it is possible for the shrewd ruler to run up a tidy profit from such ventures; buying when the price is low, selling when it is high, eventually accumulating a wealth of world-ruling proportions.

Each bushel of grain and each acre of land is considered as one 'unit' of wealth; if the ruler can accumulate one million units, the world is his; he has 'won' the game. There is, of course, a way in which the game may be 'lost'. To do this is very simple; lose all your subjects. The easiest way to do this is not to feed them: if the Royal Granary is empty and there is no more land to sell, or if the ruler decides to be greedy and keep all the wealth to himself and neglects the people, he may find the computer politely informing his that he has just run out of subjects and is out of a job.

There are, as in any society, a number of absolute rules which must be observed, even by omnipotent monarchs. In KINGDOM, each subject requires a minimum of 10 bushels of grain per year as food in order to survive; each subject is capable of planting and tending a maximum of 2 acres of land; each acre of land planted requires 3 bushels of seed. The ruler may decide to starve his population, but he can't feed them when the storage house is empty (after all, people can't eat credit). If the ruler tries to violate a rule of this sort, it is the Scribe's duty to inform that he has committed a no-no, and asks for an alternate choice.

Once the ruler has made the required decisions, they are *final*; from this point on, the natural elements prevail, and the ruler has no further voice in what progresses in the year which follows. Many things may happen in a year: perhaps there will be rain, which increases the harvest per acre, or drought, which decreases it. A plague may strike the people, drastically reducing the population. An earthquake may destroy valuable land. A thief may break into the Royal Granary and steal your grain. If this isn't enough, the Huns may attack the kingdom, pillaging your grain, killing your subjects, burning valuable farmland and destroying crops. If you survive all this, there is always the resident hoarde of rats, waiting to dive in and eat the harvested grain as fast as it comes in (if you can get it into the Granary , it will be safe) – good exterminators are hard to come by in medieval times.

On the other hand, the fleet may come in with a shipment of grain for the kingdom from the outer provinces, just as supplies are running low, or the exploration of neighboring lands may result in a border expansion, increasing the kingdom's acreage and population accordingly.

The odds of any of these occurances happening in a given year are known, but the ruler has no direct control over them; the distribution is relatively random. This makes for an interesting (and sometimes frustrating) game.

There are, however, other factors which are at least somewhat under the ruler's control. If the population is underfed, there will be starvation in the land; if enough people get hungry, there may be a food riot, which is a form of social protest in which the people break into the Royal Granary and make off with whatever is to be found (not to mention calling the ruler a few dirty names in passing). Conversely, if the ruler overfeeds the populace, it tends to increase by an amount proportional to the surplus (the exact scientific explanation for this effect has yet to be found, but it is generally referred to as the 'Adam and Eve Law'). There are additional fine points to the game which can go without specific mention here; suffice it to say that there are enough to make for an interesting game.

Now that you have a general idea of what KINGDOM is all about, it is time to get into what is perhaps the most interesting characteristic of the game: its effect on the people who play it.

The true history of the game of KINGDOM began in the fall of 1972, when it appeared on a Honeywell 6060 system at the Milwaukee Technical College, implemented by one of the authors of this article, who, at that time, was an employee-student of the Physics department there. After a few weeks of working out the fine points of the game, it became 'available for public consumption' (which means that anyone who could get their hands on a copy of the program could play it). This immediately resulted in a number of problems, among them the fact that timesharing usage on the Honeywell went up by a noticeable amount. It was then that the strange effects of the game on people first became noticeable as well. Armed with rule sheets, portable calculators, and various touches of greed, a veritable army of students descended on the system, each with his or her own 'infallible system' for winning. As it turned out, none of these were truly infallible, but they did their best, to the point that a number of departments in the school banned the playing of KINGDOM during regular class hours.

Sometimes it was just as much fun to watch someone else play the game; this was great sport, especially some of the Physics department staff, who would sit at the terminal mumbling 'greed! greed!' as they typed in various transactions, and cursed loudly as the Huns attacked and made off with hardearned wealth.

by lee schneider - todd voros

Having pretty well saturated one school, a copy of the program was slipped into the Marquette University Computer Center in Milwaukee just before Christmas of '72 (arriving at the back door in a plain brown envelope in the dead of night), and, lo and behold, suddenly appeared on their timesharing system (which consisted of one antique IBM 360/30). Timesharing usage on the system went up a few hundred percent; mostly due to engineering students who, after a hard day slaving over a hot slide rule (remember them?), would relax by trying to rule the world a few times. The staff members at this comp center did not ban the game, nor did they complain about excessive computer usage – they were too busy playing the game themselves.

Out of all this playing came an interesting development: a computer was programmed to play the KINGDOM game *by itself.* Though this may seem like a silly thing for a big computer to be doing, there was a definite reason.

It seems that with so many people playing and trying to win the game (and sometimes succeeding), there was constant discussion and disagreement on what was the 'best' strategy for success. Some players believed that playing conservative was the answer: they often had reigns which lasted over 100 'years', carefully maintaining a stable population and depending on the natural course of events to eventually allow for a win. Others preferred the reckless style of play; gambling on long odds with every thing they had, neglecting the populace in the interest of a quick profit, keeping nothing in reserve for hard times. The latter style of play (which became known as KAMIKAZE KINGDOM) resulted in an occasional win in record time, but with a majority of games ending in spectacular wipeouts due to one nautral disaster or another.

The former camp believed that *consistent* winning was the object of a successful strategy; the latter insisted that the *quick* win was the thing. Neither group could come up with a definite strategy which achieved either goal, and, with the randomness involved in each game, a meaningful comparison of two strategies could not be made unless a terrifically large number of games could be played using each strategy, which nobody (ourselves included) was willing to do.

Enter the computer. To resolve the argument, the original authors of KINGDOM (namely us) spent most of the summer of '73 writing and rewriting a monsterous program called RAMSES. This program, which was run on Marquette University's Engineering Department's old (and now defunct) IBM 7040 computer system, played the game of KINGDOM by itself, blinking its console lights furiously as it planted, harvested, bought and sold. Running at a rate of one game every 5-10 seconds, RAMSES played the game in groups of 100 games each (called Dynasties), looking over its won/lost record at the end of each Dynasty and modifying its strategy accordingly to try to improve it. By changing the parameters of the RAMSES program, the computer could be instructed to play either conservative or liberal; 'success' could be defined as either consistent winning or fast winning of games. A sub-program of RAMSES called PLAYER simulated the human player, and another sub-program called MASTER kept track of the game records and statistics, and based on these, juggled the parameters automatically in search of improving the play.

Ten Dynasties made an Era, and at the end of each Era, the computer spouted forth masses of printout describing how the games were going, what strategy was being used, and the factors used for making decisions, the shortest successful game during each Dynasty and the longest, and various other information, which after an average day's run, amounted to a pile of printout about one foot high.

Occasionally, programming bugs in RAMSES would result in some interesting results; like the time the random number generator got stuck and a game played for 15000 years (even RAMSES himself couldn't do that), or the time the population was inadvertently set at zero, resulting in the computer running through each game trying to get rid of all of the kingdom's population, then spending great amounts of time at the end of each Dynasty trying to figure out why it wasn't winning any games.

By the end of the summer, various versions of RAMSES had played, as close as we are able to compute, about 1.5 million games of KINGDOM. We never did find any 'sure win' strategies, though the computer did develop a mode of play which generally resulted in a better track record than the average human player: For a numberof months, RAMSES held the school record for both the shortest and longest winning games. The computer also found a number of interesting tactics for playing, most of which had been previously discovered by human players (such as the trick of converting all your grain into land when the population gets too large, enabling you to starve the populace and suffer no loss of grain due to food riots, as the land may be sold and re-converted to grain the next year).

Our experiences with the RAMSES program provided us with three things: (1) an interesting experience in the construction of a self-learning, self optimizing program, (2) the satisfaction of knowing that we [and the computer] had played more games of KINGDOM than anyone in the place, and (3) a lifetime supply of scratch paper to be written on the back of.

We discussed our project with a number of people during that time, among them the local representative of DEC, who thought it might be an interesting item to write up for the DEC educational computer magazine, EDU. Since one of the few things we enjoyed more than playing KINGDOM at that time was talking about playing KINGDOM, a short article got written up and sent off to the DEC office for them to look over, and eventually appeared in EDU No. 12 (Summer, 1974). At the end of the article, we offhandedly mentioned that if anyone wanted a copy of the program listing for KINGDOM, they could drop us a line requesting KINGDOM along with a stamped, self-addressed envelope and we would send them one. After all, why not share the game with other unfortunate computer freaks who had never experienced KINGDOM before?

Our mistake was in underestimating the number of computer freaks in the country. For the next four months after the article came out, we spent our evenings folding up listings and mailing them to New York, Virginia, Illinois, Colorado, California, Arizona, Texas, and half the provinces of Canada. We even sent a copy to a Navy Lieutenant in the Pentagon, where he put it onto an HP2100C minicomputer system and wrote back telling us about all the Army majors and colonels who gathered at the computer center every lunch hour and practiced ruling the world (yes folks, that's our defense department at work): the only complaint he received was that the Army brass got annoyed when the Huns attacked and they had no retaliatory strike power (as one player remarked, "the least the computer could do is let us bomb the bastards!").

At the present time, we can report that KINGDOM is certainly alive and well in a number of computer centers around the country, satisfying that basic rule-the-world urge for amateur Napoleon and Attilas and Marie Antoinettes everywhere.

The last time we saw the game being played at Marquette, it was running as the second most popular game in the center, right behind the Star Trek game *SPACEWAR* (perhaps this is because SPACEWAR lets the player rule the whole galaxy, whereas the KINGDOM player must be content with just the earth). The University of Wisconsin – Milwaukee has a number of versions running on its DEC TSS/8 system, including a recently added version written in Spanish for the benefit of students and visitors who are more comfortable with that language; other foreign language versions are in the planning.

Some versions of KINGDOM on the larger computer systems have been provided with the option of 'save' the status of a game in case the player has to leave in the middle, such that he may return and pick up where he left off an hour later or the next day. A number of modifications have been made in the game itself by various indivduals, but there would be insufficient space to list all the variations here.

One final note, though: since KINGDOM was first introduced several years ago, we have been accumulating notes on possible modifications, new options, and various modifications which could be made in the game to make it even more interesting and/or challenging. If time ever permits, we hope to sit down someday and write a game of 'super-KINGDOM' (tentatively named EMPIRE), which would include such items as agricultural development, mining and manufacturing, trading and/or warfare with neighboring kingdoms, a monetary system, military and police forces, civil service, and perhaps even a multi-player option where two or more players compete (through the computer) for control of the resources. In the meantime, though, there are other things to be taken care of, programming to be done, bills to be paid, and so forth: and by the way, we see the lunch hour is approaching – time to go and rule the world again!

Lee L. Schneider
Robotics and Artificial
Intelligence Laboratory
University of Wisconsin - Milwaukee

Todd L. Voros
A. O. Smith Corp.
Data Systems Division
Milwaukee

```
 10 REM "KINGDOM" FOR TSS/8 BASIC
 11 REM
 12 REM  VERSION 1   MOD 2   12/28/73
 14 REM
 15 REM WRITTEN BY:
 16 REM       T. VOKOS          A.O. SMITH CORP.
 17 REM       L. SCHNEIDER      UWM, MILWAUKEE
 18 REM
 20 RANDOMIZE
 25 DEF FNR(Z1)=INT(INT(Z1)*RND(0))
 30 DEF FNL(Z2)=FNR(100)-Z2
 35 REM
 98 REM ***SET INITIAL PARAMETERS***
 99 REM
100 LET Y=0
105 LET L0=10↑6
110 LET L1=3
115 LET N0=FNR(75)+75
120 LET L2=FNR(250)+250
125 LET N1=FNR(3000)+2000
130 LET L3=0
135 LET N2=0
136 PRINT
137 REM
138 REM ***PRINT YEARLY REPORT***
139 REM
140 PRINT "<*> <*> <*> <*> <*> <*> <*> <*> <*> <*>"
145 PRINT
150 PRINT "REPORT FOR YEAR ";Y
155 PRINT
160 PRINT "POPULATION IS ";N0
165 PRINT "ACRES OF LAND OWNED ";L2
170 PRINT "BUSHELS IN STORAGE ";N1
175 PRINT "PRICE OF LAND IS ";L1;" BUSHELS PER ACRE"
180 PRINT
190 REM
191 REM ***READ AND VERIFY LAND TRANSACTIONS***
192 REM
215 PRINT "HOW MANY ACRES TO BUY?"
220 INPUT B
225 LET B=INT(B)
230 IF B<0 GOTO 2020
235 IF B=0 GOTO 270
240 LET A=N1-B*L1
245 IF A>=0 GOTO 260
250 PRINT "YOUR STORAGE IS ONLY ";N1;" BUSHELS!"
255 GOTO 215
260 LET N1=A
265 LET L2=L2+B
270 PRINT "TO SELL?"
275 INPUT C
280 LET C=INT(C)
285 IF C<0 GOTO 2020
290 IF C=0 GOTO 325
295 LET A=L2-C
300 IF A>=0 GOTO 315
305 PRINT "YOU ONLY OWN ";L2;" ACRES!"
310 GOTO 270
315 LET L2=A
320 LET N1=N1+C*L1
325 IF (B+C)=0 GOTO 335
330 PRINT "TRANSACTION RESULTS: LAND ";L2;" ACRES; GRAIN ";N1;" BUSHELS"
332 REM
333 REM ***TEST FOR WIN***
334 REM
335 IF (L2+N1-L0)>=0 GOTO 2010
340 IF N1=0 GOTO 490
342 REM
343 REM ***READ AND VERIFY FOOD AND SEED ALLOTMENT***
344 REM
345 PRINT
350 PRINT "HOW MANY BUSHELS FOR FOOD?"
355 INPUT N2
360 N2=INT(N2)
365 IF N2<0 GOTO 2020
370 LET A=N1-N2
375 IF A>=0 GOTO 390
380 PRINT "YOUR STORAGE IS ONLY ";N1;" BUSHELS!"
385 GOTO 350
390 LET N1=A
395 IF N1=0 GOTO 490
400 PRINT "HOW MANY ACRES TO BE PLANTED?"
405 INPUT L3
410 LET L3=INT(L3)
415 IF L3<0 GOTO 2020
420 IF L3=0 GOTO 500
425 IF (L2-L3) >=0 GOTO 440
430 PRINT "YOU ONLY OWN ";L2;" ACRES!"
435 GOTO 400
440 IF (2*N0-L3) >=0 GOTO 455
445 PRINT "YOUR POPULATION IS ONLY ";N0;" PEOPLE!"
450 GOTO 400
455 LET A=N1-3*L3
460 IF A>=0 GOTO 475
465 PRINT "YOUR STORAGE IS ONLY ";N1;" BUSHELS!"
470 GOTO 400
475 LET N1=A
480 IF N1>0 GOTO 500
485 PRINT
490 PRINT "STORAGE IS NOW EMPTY...GOOD LUCK!"
491 REM
495 REM ***COMPUTE EFFECTS OF FOOD ALLOTMENT***
497 REM
```

official rules

The game of KINGDOM is based upon the premise that the player is to act as the ruler of a mythical, medieval country. The ruler must make decisions which maintain the kingdom and advance the player toward the goal.

The goal of the player is to rule the world. This is accomplished by collecting a total wealth equal to, or exceeding, one million units. Wealth is measured in terms of two quantities: acres of land owned, and bushels of grain in storage.

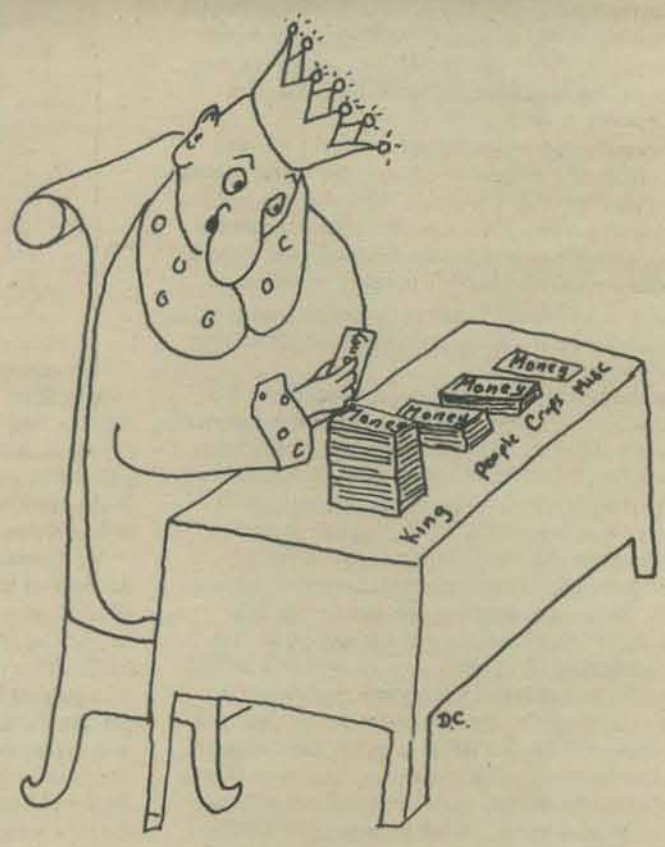
At the start of the game, the player is assigned an initial population, a parcel of land, and a storage house of grain. At the beginning of each year, the player must make decisions which will concern the transaction of land and grain, allot food to the populace, and specify the amount of land to be planted. A yearly report is printed at the beginning of each year, giving the total resources of the kingdom at that time.

If the player makes a decision which exceeds the limits of the total resources at that time, the player is informed of the error and the question is repeated.

The player wins at any time when the total wealth (acres plus bushels) equals or exceeds, one million units. The player loses if the total population reaches a value of zero.

Game constants are of three basic types. The first are absolute constants, which are fixed at the same value throughout the play of the game. The second type are factors which are always present, but change on a fairly random basis each year. The third type is usually referred to as random occurrence, which governs a number of happenings which may or may not occur in a given year, based upon a standard fixed percentage.

All user input is in the form of numeric values. The user may terminate the play at any time by entering a negative value in response to any question.



```
500 LET Y=Y+1
505 LET N3=FNR(N0/3+3)
510 LET N4=FNR(N0/4+2)
515 LET N5=N0-IN1(N2/10)
520 IF N5>0 GOTO 560
525 IF N5=0 GOTO 590
535 LET A=FNR(3-N5/2)
536 PRINT
540 PRINT "***FOOD SURPLUS***  POPULATION INCREASE "JA
545 LET N5=0
550 LET N3=N3+A
555 GOTO 590
560 IF (FNL(5*(N5-2))) >0 GOTO 590
565 LET A=FNR((N5*N1)/(2*N0))
570 PRINT
575 PRINT "***FOOD RIOTS*** "JA" BUSHELS LOST"
580 LET N1=N1-A
590 IF FNL(10) >0 GOTO 620
595 LET A=INT(N0/3)+FNR(N0/2+2)
597 REM
598 REM ***COMPUTE RANDOM OCCURANCES***
599 REM
600 PRINT
605 PRINT "***PLAGUE*** "JA" DIED"
610 LET N4=N4+A
620 IF FNL(10) >0 GOTO 670
625 LET A=FNR(N0/5)+INT(N0/5)
630 LET B=FNR(N1/20)+INT(N1/20)
635 LET C=FNR(L2/50)
640 PRINT
645 PRINT "***HUNS ATTACK***"
650 PRINT A" PEOPLE KILLED "JB" BUSHELS TAKEN "JC" ACRES DESTROYED"
655 LET N4=N4+A
660 LET N1=N1-B
665 LET L2=L2-C
670 IF FNL(15) >0 GOTO 705
675 LET A=FNR(20)+10
680 LET B=FNR(N0+250)+50
685 PRINT
690 PRINT "***BORDER EXPANSION*** YOU GAINED "JA" PEOPLE; "JB" ACRES"
695 LET N3=N3+A
700 LET L2=L2+B
705 LET N0=N0+N3-N4-N5
710 IF N0<=0 GOTO 2015
715 PRINT
720 PRINT N3" ARRIVED"
725 PRINT N5" DIED OF STARVATION"
730 PRINT N4" DIED NATURAL CAUSES"
735 IF FNL(10) >0 GOTO 760
740 LET A=FNR(N1/20)+INT(N1/20)
745 PRINT
750 PRINT "***THEFT*** "JA" BUSHELS STOLEN"
755 LET N1=N1-A
760 IF FNL(10) >0 GOTO 785
765 LET A=FNR(L2/10)+INT(L2/20)
770 PRINT
775 PRINT "**********EARTHQUAKE********** "JA" ACRES DESTROYED"
780 LET L2=L2-A
785 IF FNL(15) >0 GOTO 810
790 LET A=FNR(100+INT(L2/100))+500
795 PRINT
800 PRINT "***GRAIN SHIPMENT ARRIVES*** "JA" BUSHELS"
805 LET N1=N1+A
810 IF FNL(15)>0 GOTO 835
815 LET L1=FNR(2)+1
820 PRINT
825 PRINT "***DROUGHT***"
830 GOTO 860
835 IF FNL(15) >0 GOTO 852
840 LET L1=FNR(3)+7
845 PRINT
850 PRINT "***RAIN***"
851 GOTO 860
852 LET L1=FNR(4)+3
855 REM
856 REM ***COMPUTE HARVEST***
857 REM
860 LET A=L1*L3
865 LET B=FNR(A/2)
870 LET C=A-B
875 PRINT
880 PRINT
885 IF A=0 GOTO 910
890 PRINT "HARVEST WAS "JL1" BUSHELS PER ACRE FOR A TOTAL "JA" BUSHELS"
895 PRINT "LOSS TO RATS "JB" BUSHELS; NET HARVEST WAS "JC" BUSHELS"
900 LET N1=N1+C
905 GOTO 130
910 PRINT "HARVEST WAS "JL1" BUSHELS PER ACRE FOR A TOTAL "JA" BUSHELS"
915 GOTO 900
2000 REM
2001 REM ***SPECIAL MESSAGES FOR ENDINGS***
2002 REM
2010 PRINT
2011 PRINT "***CONGRATULATIONS*** YOU NOW RULE THE WORLD!"
2012 GOTO 2020
2015 PRINT
2016 PRINT "***DIASTER*** - THERE ARE NO MORE PEOPLE LEFT!"
2020 PRINT
2021 PRINT "YOUR REIGN LASTED "JY" YEARS"
2046 END
```

rules con't

The following are absolute game constants:

FOOD – Each subject of the kingdom requires a minimum of 10 bushels of grain per year for use as food.

SEED – Each acre of land planted requires 3 bushels of grain per year for use as seed.

LABOR – Each subject may plant a maximum of 2 acres per year.

The following are variable factors:

LAND PRICE – (expressed as bushels per acre) – normally varies between 3 and 6 bushels per acre, unless affected by the occurrence of rain or drought. The harvest per acre for a given year becomes the trading value for the following year.

POPULATION – normally varies by 20 to 40% due to natural causes, unless affected by other natural occurrences.

GRAIN LOSS – from 0 to 50% of the harvest of a given year may be lost to rats. Only the harvest (not existing grain in storage) is susceptible to attack.

OVERFEEDING – a food surplus occurs when more grain is alloted for food than the minimal requirement. There is about a 50% probability of gaining one person for each 20 bushels over the minimum.

UNDERFEEDING – the ruler may starve off 2 persons per year without ill effect. Each starvation over 2 increases the probability of food riots by 5% each. A food riot may result in a loss of up to 50% of the grain in storage.

The following are purely random factors: (the probability of the event's occurrence in any given year is given in parenthesis):

PLAGUE – (10%) – may reduce population up to 80%.

THEFT – (10%) – may reduce grain storage by up to 10%.

EARTHQUAKE – (10%) – may reduce acreage by up to 15%.

ATTACK BY HUNS – (10%) – may reduce population up to 40%, storage up to 10% and land up to 2%.

RAIN – (15%) – increases harvest to 7, 8 or 9 bushels/acre.

DROUGHT – (15%) – decreases harvest to 1 or 2 bushels/acre.

GRAIN SHIPMENT – (15%) – increases grain storage – depends on the size of the kingdom (acres of land).

BORDER EXPANSION – (15%) – increases population and land holdings – depends on present population of kingdom.

CHOMP for BASIC

The game of CHOMP was introduced in Martin Gardner's Mathematical Games Department of *Scientific American* for January, 1973. It was invented by David Gale at UC Berkeley.

This version is our first pass. We changed the rules somewhat from the published version. Not only that, but this version doesn't play the game at all – it just keeps track of the moves and informs the loser (who already knows he lost, anyway).

Scientific American has described some winning strategies for boards of given sizes. In our version the players INPUT the dimensions – makes it harder to figure out the trivial wins. The rest of the way our program works should be clear from the directions. We're still finding out how kids solve the puzzle of deciphering printed rules to games (this is a game in itself sometimes). The program runs on HP 2000 series, and on 8K PDP8/L with Edu 20.55.

Peter Lynn Sessions Published in PCC, Volume 1, Number 3.

```
100  REM *** THE GAME OF CHOMP *** COPYRIGHT PCC 1973 ***
110  PRINT
120  PRINT "THIS IS THE GAME OF CHOMP (SCIENTIFIC AMERICAN, JAN 1973)"
130  PRINT "WANT THE RULES (1=YES, 0=NO!)";
140  INPUT R
150  IF R=0 THEN 340
160  F=1
170  R=5
180  C=7
190  PRINT "CHOMP IS FOR 1 OR MORE PLAYERS (HUMANS ONLY)."
200  PRINT
210  PRINT "HERE'S HOW A BOARD LOOKS (THIS ONE IS 5 BY 7):"
220  GOSUB 540
230  PRINT
240  PRINT "THE BOARD IS A BIG COOKIE - R ROWS HIGH AND C COLUMNS"
250  PRINT "WIDE. YOU INPUT R AND C AT THE START. IN THE UPPER LEFT"
260  PRINT "CORNER OF THE COOKIE IS A POISON SQUARE (P). THE ONE WHO"
270  PRINT "CHOMPS THE POISON SQUARE LOSES. TO TAKE A CHOMP, TYPE THE"
280  PRINT "ROW AND COLUMN OF ONE OF THE SQUARES ON THE COOKIE."
290  PRINT "ALL OF THE SQUARES BELOW AND TO THE RIGHT OF THAT SQUARE"
300  PRINT "(INCLUDING THAT SQUARE, TOO) DISAPPEAR -- CHOMP!!"
310  PRINT "NO FAIR CHOMPING SQUARES THAT HAVE ALREADY BEEN CHOMPED,"
320  PRINT "OR THAT ARE OUTSIDE THE ORIGINAL DIMENSIONS OF THE COOKIE."

330  PRINT
340  PRINT "HERE WE GO..."
350  DIM A(10,10)
360  F=0
370  FOR I=1 TO 10
372  FOR J=1 TO 10
375  LET A(I,J)=0
377  NEXT J
379  NEXT I
380  PRINT
390  PRINT "HOW MANY PLAYERS";
400  INPUT P
410  I1=0
420  PRINT "HOW MANY ROWS";
430  INPUT R
440  IF R <= 9 THEN 470
450  PRINT "TOO MANY ROWS (9 IS MAXIMUM). NOW, ";
460  GOTO 420
470  PRINT "HOW MANY COLUMNS";
480  INPUT C
490  IF C <= 9 THEN 530
500  PRINT "TOO MANY COLUMNS (9 IS MAXIMUM). NOW, ";
510  GOTO 470
530  PRINT
540  FOR I=1 TO R
550  FOR J=1 TO C
560  A(I,J)=1
570  NEXT J
580  NEXT I
590  A(1,1)=-1
600  REM PRINT THE BOARD
610  PRINT
620  PRINT TAB(7);"1 2 3 4 5 6 7 8 9"
630  FOR I=1 TO R
640  PRINT I;TAB(7);
650  FOR J=1 TO C
660  IF A(I,J)=-1 THEN 700
670  IF A(I,J)=0 THEN 720
680  PRINT "* ";
690  GOTO 710
700  PRINT "P ";
710  NEXT J
720  PRINT
730  NEXT I
740  PRINT
750  IF F=0 THEN 770
760  RETURN
770  REM GET CHOMPS FOR EACH PLAYER IN TURN
780  LET I1=I1+1
790  LET P1=I1-INT(I1/P)*P
800  IF P1 <> 0 THEN 820
810  P1=P
820  PRINT "PLAYER ";P1
830  PRINT "COORDINATES OF CHOMP (ROW,COLUMN)";
840  INPUT R1,C1
850  IF R1<1 THEN 920
860  IF R1>R THEN 920
870  IF C1<1 THEN 920
880  IF C1>C THEN 920
890  IF A(R1,C1)=0 THEN 920
900  IF A(R1,C1)=-1 THEN 1010
910  GOTO 940
920  PRINT "NO FAIR. YOU'RE TRYING TO CHOMP ON EMPTY SPACE!"
930  GOTO 820
940  FOR I=R1 TO R
950  FOR J=C1 TO C
960  A(I,J)=0
970  NEXT J
980  NEXT I
990  GOTO 610
1000  REM END OF GAME DETECTED IN LINE 900
1010  PRINT "YOU LOSE, PLAYER ";P1
1020  PRINT
1030  PRINT "AGAIN (1=YES, 0=NO!)";
1040  INPUT R
1050  IF R=1 THEN 340
1060  END
```

CHOMP for 8008

Any number of players can play CHOMP. It is played (in this version) on an 8 by 8 board of +'s and *'s in the upper right hand corner. Players take turns chomping until one player is forced to take the poison *. To take a Chomp, you type in the letter and number of one of the +'s. That +, and all of the +'s to the left and below disappear. No fari chomping empty space.

This version of CHOMP uses the Mark-8 with the TV Typewriter I and an ASCII keyboard. The TVT is on output port 1, and the keyboard is on input port 0. Strobe lines are appropriately connected (as shown in the diagram).

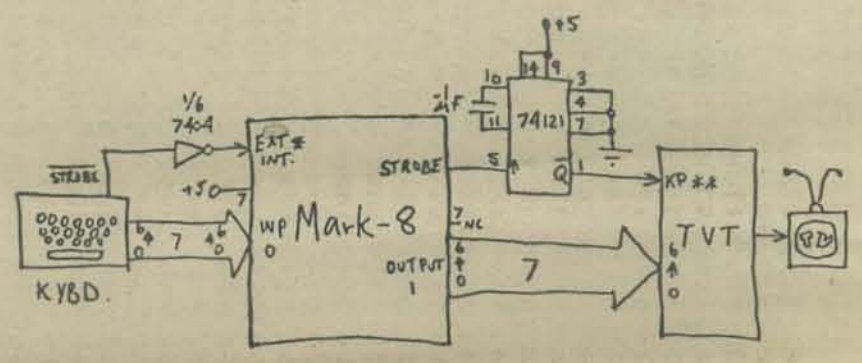
First load the "Load Comments" program then interrupt with a Restart 005. Now set the switch register to 300 (NOP) and type in the comments using returns and line feeds as shown. The output 0 LED's will count characters as they are loaded. LED's should read 365 when done.

Now load the program from 0 000 to 0 164. Interrupt with 005, then set switch register to 300, home TVT and press any key. When the game is over clear the screen and hit any key to play again. Have fun!

May 20, 1975

Phil Mork
12 Woodland Road
Weston, MA. 02193

Published in Micro 8 Computer User Group
Cabrillo Computer Center
4350 Constellation Rd., Lompoc, Ca. 93436



* Remove jumper!
** Remove cursor C16

```
Load Comments                          Comments

1 000 066  LLI          1 000   TYPE A LETTER AND A NUMBER(ret)
  001 000                       TO TAKE A BITE, NO FAIR BITING(ret)
  002 056  LHI                  AIR. BITE THE * AND YOU LOSE(3 ret)
  003 001                       ABCDEFGH(ret)
  004 306  LAL                  ++++++*1(ret)
  005 121  OUT 010              ++++++++2(ret)
  006 000  HLT                  ++++++++3(ret)
  007 101  INP 000              ++++++++4(ret)
  010 123  OUT 011              ++++++++5(ret)
  011 370  LMA                  ++++++++6(ret)
  012 060  INL                  ++++++++7(ret)
  013 104  JMP                  ++++++++8(7 ret)
  014 004                       GO!(2 space) (LF) (space)
  015 000
                        1 300   (6 ret)NEXT?(LF)

                        1 314   (ret)CHOMP! YOU LOSE. PLAY AGAIN?(11 ret) (LF)

                          -Program-

000 000 HLT     040 011 DCB     100 -           140 066 LLI
    066 LLI         021 DCC         -               314 314
    000             110 JFZ         106 CAL         106 CAL
    106 CAL         033             117             150
    150             000             000             000
    000             006 LAI         074 CPI         005 RST
    106 CAL         040 040         001 001         -
    117             106 CAL         150 JTZ         -
010 000         050 121         110 140         150 056 LHI
    340 LEA         000             000             001 001
    074 CPI         041 DCE         104 JMP         307 LAM
    010 010         110 JFZ         022             074 CPI
    150 JTZ         045             000             212 212
    102             000             -               053 RTZ
    000             006 LAI         -               106 CAL
    106 CAL         015 015             000 HLT     121
020 117         060 106 CAL     120 101 INP 001 160 000
    000             121             123 OUT 011     060 INL
    320 LCA         000             044 NDI         104 JMP
    334 LDL         343 LED         017 017         150
    016 LBI         011 DCB         056 LHI         000
    013 011         110 JFZ         000 000
    006 LAI         045             051 DCH
    015 015         000             300 LAA
030 106 CAL     070 066 LLI     130 300 LAA
    121             300 300         300 LAA
    000             106 CAL         053 RTZ
    006 LAI         150             104 JMP
    015 015         000             126
    106 CAL         104 JMP         000
    121             006             -
    000             000             -
```

WITCHY

THIS GAME USES A MASKING TECHNIQUE AND SEVERAL RANDOMIZING SEQUENCES. HAS LOTS OF ACTION TO KEEP THE PLAYER INTERESTED. MACHINES WITH BETTER STRING FACILITY COULD PROBABLY REDUCE THE PROGRAM A BIT.

O.S.

```
 1 REM "WITCHY THE NAME WITCH" BY THE OLD SOLDIER (WALTER E WALLIS)
 2 REM RIGHTS SHARED WITH P.C.C. TO BENEFIT COMMUNITY COMPUTER CENTERS

 4 REM SET UP FOR PDP-8L, EDU20-C
 5 PRI\PRI\PRI
 8 RANDOM
 9 Z=1
10 PRI"HELLO THERE, DEARIE, I AM WITCHY THE NAME WITCH!"
15 PRI"I HAVE CAPTURED FOUR OF YOUR FRIENDS AND AM HOLDING THEM"
20 PRI"FOR RANSOM. IF YOU WANT ME TO RELEASE THEM, YOU MUST"
25 PRI"TELL ME THEIR NAMES."
30 GOSUB 100
34 IF Z>1 THEN 100
35 PRI"THANK YOU DEARIE, "E$" , CACKLE, CACKLE"\FORI=1TO20\PRICHR$(7);

36 NEXT I
40 PRI"YOU FOOL, IT WASN'T YOUR FRIENDS I WANTED,";
41 PRI"IT WAS THEIR NAMES!!!"
45 PRI"AND YOU GAVE THEM TO ME"CHR$(7)"   NOW UNLESS YOU CAN GUESS"
50 PRI"WHERE I HAVE HIDDEN THEM, YOUR FRIENDS WILL HAVE TO GO THROUGH"

55 PRI"LIFE WITHOUT NAMES. HE HA HO HU HEE HAA!!!!!!";
56 FOR I=1 TO 10 \ PRI CHR$(7);\NEXT I
60 PRI
65 PRI"I HAVE HIDDEN EACH NAME BEHIND A FENCE THAT LOOKS LIKE THIS:"
67 PRI\PRITAB(30)"XXXXXX"CHR$(13)TAB(30)"000000"\PRI
69 PRI"THERE ARE 6 BOARDS IN EACH FENCE. IF A BOARD FALLS DOWN"
71 PRI"(AND ONE ALWAYS DOES) YOU CAN SEE ONE LETTER OF THE NAME";
72 PRI"BEHIND";
73 PRI"THE FENCE. (I CUT OFF ALL LETTERS OVER 6 AND ATE THEM)"
74 PRI"IF YOU GUESS WHICH NAME IS BEHIND A FENCE, I LET THAT NAME GO."

76 PRI"IF YOU GUESS WRONG, I EAT THAT NAME."
78 PRI"IF YOU PICK MY FENCE BY MISTAKE I EAT YOUR NAME AND THE GAME"
80 PRI"IS OVER, YOU LOSE."
82 PRI"IF YOU GUESS MY FENCE ON PURPOSE, I EAT MY NAME AND YOU WIN."
84 PRI"NAMES MUST BE SPELLED EXACTLY THE SAME, OR THEY DON'T COUNT."
86 GO TO 130
100 PRI"WHAT IS YOUR FIRST FRIEND'S NAME";\INPUT A$
105 PRI"WHAT IS YOUR SECOND FRIEND'S NAME";\INPUTB$
110 PRI"WHAT IS YOUR THIRD FRIEND'S NAME";\INPUT C$
115 PRI"WHAT IS YOUR FOURTH FRIEND'S NAME";\INPUT D$
120 PRI"AND WHAT IS YOUR NAME, DEARIE";\INPUT E$
121 IF Z>1THEN 130
122 RETURN
130 F$="WITCHY"\PRI
131 REM KNOCKING BOARDS OUT OF THE FENCE
135 A= RND(0)\IF A<.17 THEN 140
136 IF A<.33 THEN 141\ IFA<.5 THEN142\IFA<.67THEN143\IFA<.83THEN144
139 X$=" XXXXX"\O$=" 00000"\GOT150
140 X$="X XXXX"\O$="0 0000"\GOT150
141 X$="XX XXX"\O$="00 000"\GOT150
142 X$="XXX XX"\O$="000 00"\GOT150
143 X$="XXXX X"\O$="0000 0"\GOT150
144 X$="XXXXX "\O$="00000 "\GOT150
150 T$="\\\\\\"\ REM MIXING UP NAMES
152 ON (INT((RND(X)*100)/20))+1 GOTO 153,154,155,156,157
153 G$=A$\H$=C$\I$=F$\J$=D$\K$=B$\GOT160
154 G$=B$\H$=D$\I$=A$\J$=F$\K$=C$\GOT160
155 G$=C$\H$=F$\I$=B$\J$=A$\K$=D$\GOT160
156 G$=D$\H$=A$\I$=C$\J$=B$\K$=F$\GOT160
157 G$=F$\H$=B$\I$=D$\J$=C$\K$=A$\GOT160
158 REM BUILDING FENCE
160 FOR I=1 TO 5\ PRI X$"       "; \ NEXTI
161 PRI CHR$(13);
162 FOR I=1 TO 5 \ PRI O$"       ";\ NEXT I
163 PRI CHR$(13);
164 REM HIDING NAMES
165 PRIG$,H$,I$,J$,K$
166 PRI"FENCE 1","FENCE 2","FENCE 3","FENCE 4","FENCE 5"
167 PRI
170 FOR I=1 TO 5 \ PRI"O.K., WHO'D I HIDE BEHIND FENCE "I" ";
171 INPUT L$
172 ON I GOSUB   180,182,184,186,188
173 NEXT I
179 REM CHECKING GUESSES
180 IF L$=G$ THEN 190 \ IF G$=F$ THEN 200\PRI"YOU MISSED! "
181 PRI"IT WAS "G$;\ GOT192
182 IF L$=H$ THEN 190 \ IF H$=F$ THEN 200 \ PRI"YOU MISSED! "
183 PRI"IT WAS " H$;\GOT 192
184 IF L$=I$ THEN 190 \ IF I$=F$ THEN 200 \ PRI"YOU MISSED! "
185 PRI"IT WAS "I$; \ GOT 192
186 IF L$=J$ THEN190 \ IFJ$=F$ THEN 200 \ PRI"YOU MISSED! "
187 PRI"IT WAS "J$; \ GOT 192
188 IF L$=K$ THEN 190 \ IF K$=F$ THEN 200 \ PRI"YOU MISSED! "
189 PRI"IT WAS "K$;\ GOT 192
190 IF L$=F$ THEN 195 \ PRI"YOU GUESSED IT, IT WAS "L$
191 PRI"YOU MUST HAVE PEEKED, BUT I'LL FOOL YOU NEXT TIME."\RETURN
192 PRI CHR$(13);\PRITAB(7)T$" M-M-M, THAT WAS DELICIOUS..."\RETURN
195 PRI"CURSES, YOU TRAPPED ME, NOW I HAVE TO EAT MY OWN SWEET NAME"
196 PRITAB(30)F$; CHR$(13);TAB(30)T$
197 PRI"OUCH, THAT HURT!!! IF I KNEW WHO I WAS, I'D GETCHA."
198 PRI"YOU WIN, "E$\ GOT210
200 FOR J=1 TO 20 \ PRICHR$(7);\ NEXT J
201 PRI"I GOTCHA "E$;CHR$(13);TAB(9)T$ " M-M-M   GREAT!!!"
202 PRI"THE TASTIEST NAME YET!"
203 PRI"SEE YA LATER, WHATZISNAME."
210 FOR J=1 TO 3 \ PRI \ NEXT J
212 PRI"WANT TO PLAY AGAIN, DEARIE ";
213 Z=Z+1
214 INPUT M$ \ IF M$="YES" THEN 30
216 PRI"O.K., SEE YOU LATER, FELLA..."
218 END
```

ALTAIR 8800

CRITICISM and SELF CRITICISM

The article referred to by Mr. Ivanhoe requires some explanation on my part as well as my own kind of apology. Perceptive readers may have noticed that the title and graphic treatment did not quite fit the contents of the article, which was a highly favorable review of the Altair 8800 hardware.

I had written a relatively unfavorable review of the Altair on the basis of inspection of an early model shipped to PCC. Based on what I and others saw in that unit, there would be noise problems. An early phone conversation with Ed Roberts of MITS led me to believe that he had given up trying to suppress the noise and was placing his hopes on the observation that the noise reduced somewhat as more modules were plugged in.

Noise is an elusive thing, and the design considerations involved in its suppression are of the sort that are more a matter of style than of rigorously defined technique. The only real way to determine the noise sensitivity of a design is to observe it in operation. The 8800 which we had been sent was incapable of doing anything except Dompier's music program, which works by using the pickup of the noise on a radio.

PCC was about to go to press when a call came in from Ed Roberts on another matter. Since I consider myself a journalist as well as an engineer, I decided to read the article to Ed over the phone.

His answer was, essentially, that "the problem has been fixed and everyone has been told about it but you". I would be making a fool of myself if it went out as it was. With no way to check out Ed's statements before the deadline, I decided to rewrite the article to reflect Ed's statements.

I should have witheld the article until some confirmation could be obtained. I traded off my integrity for both my own convenience and for the presumed convenience of PCC. As a journalist I must apologize for this.

As an engineer, I feel that my apology should be of a more useful nature. Accordingly, I have been investigating the problems with the Altair 8800 and can make some statements and suggestions with confidence.

First - the Altair 8800 has no noise problem inherent in the bus, memory or processor that would preclude operation with reasonable reliability.

Second - the bulk of the problems with the 8800 can be traced to three sources:

(a) Inadequate power supply bypassing on the front panel circuit board.

(b) Interactions between dynamic memory refreshing and the processor during critical transient conditions such as direct memory access.

(c) Processor chips carrying the suffix "-8", which appear to have reduced margins. In several cases problems observed with these chips were resolved by substitution by others of the same type or of standard types.

Mr. Lee Felsenstein
People's Computer Company

Dear Mr. Felsenstein,

I read your article on page 22 in "P.C.C" vol. 3, issue 5, and for a moment I thought you were writing not about MITS but another company. I am not aware of what is the source of your information but if it is the maker of ALTAIR, which I suspect, you are showing only one side of the story, now here is another side.

I read the advertisement of MITS in "Radio Electronics" February 1975 issue and took all their claims at face value and wrote to them immediately on the 28th February, 1975 enclosing a bank draft for $665 plus $15 airfreight to cover the cost on one of their Altair 8800 computers and at the same time requesting information on interfacing their machine to a Facit input/output typewriter informing them that our electricity was 240 volts 50 cycles. On the 6th March I wrote again asking information on using Altair 8800 computer for numerical control on two and three axis machines with stepping motors. On receiving no reply I wrote again on the 19th and 24th March and 16th May to find out what was happening about my computer. Eventually on the 10th June I received my computer by air, paid $60 airfreight charges and noticed that no communication whatever accompanied this and no mention of the refund of the $15 already paid for freight. When I opened the computer I found that the power supply was for 100 volts and three or four capacitors in the power supply had become undone from the wire leads. As there was no physical damage to the parcel nor the computer this could only indicate poor quality of the components. I wrote to them explaining what had happened on the 10th June and again on the 11th August but to this date I have not received a reply.

It is quite apparent there is no agreement between your story and mine as far as service and quality of capacitors are concerned. As to the quality of the computer itself, so far I cannot say a thing as for obvious reasons I am not in a position to use it.

I feel that you have two alternatives: Either show this letter to somebody responsible at MITS in the hope that after you giving them such a beautiful and free write-up, they might feel morally obliged to prove your story correct, or, else publish my letter in order to keep faith with your readers, thus showing two sides of the story.

I will be obliged if you let me hear personally what action, if any, you choose to take.

yours faithfully,

Mark Ivanhoe
67 Blackshaw Avenue
Mortdale, NSW 2223
AUSTRALIA

Third - I recommend the installation of 0.1 uf disc ceramic capacitors between the +5 volt and ground pins of IC's U,A,X,T,B, and D of the front panel circuit board.

If dynamic memory is used, I recommend that the "reset" switch be conditioned so that the signal to the processor is free of bounce. One way to do this involves paralleling the switch with a 0.1 uf capacitor and adding components to the processor board to create a Schmitt trigger circuit using pins 1,2,and 3 of IC R. (see schematic).

On the memory boards (dynamic only), I recommend connecting a jumper between pins 11 and 16 of IC I (74123/AM26L123), as well as lifting pin 10 of IC T and jumpering it to pin 11.

For reliable operation of both dynamic and static memory in the same machine, I recommend using a capacitor no greater than 4700 pf for C7 on the front panel board.

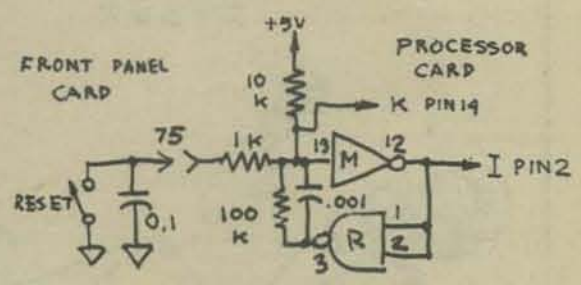
(I am making available a kit of parts and complete instructions for carrying out the above modifications. It is being marketed by Processor Technology Inc, 2465 Fourth St., Berkeley CA 94710. Price is $3.00).

Hal Singer's Micro 8 Newsletter contains another suggestion by Dave Tritsch, who relays a modification done on his Altair by Don Tarbell of the Southern California Computer Society. It involves breaking the connection on the front panel board from pin 1 of IC G to ground and jumpering pin 1 to pin 13. This is said to fix intermittent operation of the deposit switch.

Letters to PCC have indicated various levels of responsiveness on the part of MITS to problems of purchasers. Missing parts seem to arrive much faster than responses to inquiries about shipments, and applications and interfacing information seems to have the lowest priority at MITS. This last observation seems reasonable, since "customer engineering" must pretty obviously be traded off in exchange for the low purchase price.

Readers should note that I am making no statements regarding MITS' software, nor am I imputing any motive to anyone involved in that corporation. PCC and I welcome any response that MITS would care to make to this article or the accompanying letter.

Lee Felsenstein
LGC Engineering
1807 Delaware St.
Berkeley CA 94703



SIGNALS AND GLITCHES

NEW THINGS no. 1

A new 6800-based microcomputer system was demonstrated at the Sept. 3 meeting of the Bay Area Homebrew Computer club. The manufacturer-to-be wants to avoid being buried under a mountain of inquiries until things are a little further developed. Still, we can describe some of the features here.

Software features the standard 6800 features, including two accumulators, 72 basic instructions, 3 hardware and 1 software interrupt, as well as a memory-to-tape dump and loader program.

In hardware, the system will be based on plug-in cards and a bus structure, each memory card will contain 8K and the power supply will be a 12 amp OEM monster. A serial TTY I/O port is included in the basic system, as are seven-segment front panel displays and a real time, 24-hour clock (the front panel displays time when it isn't doing anything else.)

The front panel connects to input and output ports, and memory can be loaded from it. Binary and hexidecimal readout of data and address are provided, as are provisions for cycle-stealing DMA.

Got all that? Availability will be approximately December of this year, and price is yet to be announced.

GLITCH COUNTER GLITCH

One problem with the Altair has two possible fixes, which could cancel each other out if done in the same machine.

George Morrow pointed out to me that the 8800 has two tri-state drivers trying to drive the PRDY line, pin 72 on the bus. One is located in the front panel card and the other is the one in whatever memory card is being addressed. If one is trying to pull up when the other is trying to pull down, trouble can result.

The two driver chips will sweat until one of them wears out under the strain (yes, IC's DO wear out when they get into impossible situations).

Two fixes are possible; either rewire the line from the front panel to pin 3 of the bus (XRDY - same function as PRDY but not used), or rewire the lines originally hooked to pin 72 on each memory card over to pin 3.

Processor Technology has taken the latter route, so that their boards will fit in existing Altairs. But the first fix is more desireable for the user because only one change has to be made.

If BOTH fixes are done, you're right back with the original problem: two drivers fighting each other on bus pin 3.

If you have or get an Altair 8800, you may want to put a sticker inside the case showing which fix has been done. Then make sure that any new cards plugged in fit with the fix.

To summarize: the wire from the front panel which originally went to pin 72 should be moved to pin 3, OR the lines on each card (except CPU) which originally went to pin 72 should be moved to pin 3 BUT NOT BOTH.

by Lee Felsenstein

INTERRUPT!!

Don Alexander of Ohio Spectronics writes to tell us that he will have a vectored interrupt card available for the Altair 8800 around November 1.

The card will accept inputs from the Vectored Interrupt bus (VI 0 through 7) and will set latches which send the restart information onto the bus when the CPU asks for it. The latches have a priority structure to allow servicing interrupts from fast devices more frequently than from slow ones.

Don quotes $110 for an assembled card and $90 for a kit. All IC's will have sockets, and the edge connectors will be gold-plated. If the response is good, says Don, he will make available a board containing four or eight programmable interrupt ports. This will enable software control of the relative interrupt priorities.

It seems as if we're all going to have to start to learn about interrupts. No more excuses.

Don can be reached at Ohio Spectronics, 300 Colonial Avenue, Worthington OH 43085.

DRIVE A DRAGON

Bob Mullen is working on a plug-in card for the Altair 8800 which will provide 8 bits of input and output through relays and optical isolators.

The board is intended for use operating machinery such as mechanical dragons (the dragon driver?) and other equipment using high voltages or currents.

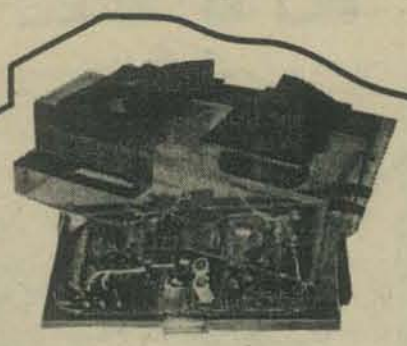
Bob will also be marketing an extender board for the Altair, useful for testing and troubleshooting other boards.

Bob can be reached through PO Box 6214, Hayward CA 94545.

YES IT IS.....NO IT ISN'T

In the current issue of Computer Notes, David Bunnell of MITS makes a comparison of the power drawn by an unnamed "widely advertised" 4K RAM board and finds that it uses 4 times the power of the Altair equivalent.

Gary Ingram of Processor Technology has sent an open letter to MITS challenging them to a detailed comparison of specifications and performance. Gary says that if it is the PT product that Bunnell is referring to, the power drawn is no more than 25% above that of the MITS dynamic board.



Here's a photo of the newest hobbyist modem, which will sell as a kit for under $100. It's so new that we can't tell you who will be making it, but we can mention some of its capabilities:

- It was designed for hobbyist and experimenter use, and has very few adjustments. Adjustment requires an audio signal generator, frequency counter, and an oscilloscope or VOM.

- It has all the necessary acoustic hardware and case included (the transparent case shown was for display only).

- It will record to and play back from audio tape without critical speed sensitivity. This capability was designed in, not just added on.

- It will operate at up to 300 Baud with very good reliability. It has a switch-selectable "high band" transmit capability which makes possible unit-to-unit communication.

- It will be called the Pennywhistle 103.

Keep your eyes on this space and the major magazines for more information.

NEW THINGS no. 2

Processor Technology has two new additions to their line of Altair 8800 plug-ins and add-ons ready to be announced.

One is the MB-1 Mother Board with bus terminator. It replaces the four small mother boards with one huge one - 1/8 inch thick and carrying power and ground traces inches wide.

The MB-1 includes terminating resistors which effectively damp out any little hiccup on the bus signals and produce a waveform of textbook quality.

The other is the VDM-1, or Video Display Module. This is basically a TV Typewriter (without keyboard) on a single card which plugs into the bus. The memory for the screen is contained on the card and is addressable for read and write by the processor.

The VDM has full upper-lower case display, 64 characters per line, 16 lines per screen, solid video inversion cursor (black characters on white background) which can be set for any and every character on the screen, and a unique scrolling capability which will let the display "crawl" without tying up the processor.

Contrary to the first published descriptions, the VDM does not use direct memory access (DMA) which ties up the bus when it is displaying. The processor is delayed 42 microseconds only when it tries to access the VDM's internal memory at an inopportune time.

More information is available from Processor Technology Inc., 2465 4th St., Berkeley CA 94710.

BYTE and other things to chew on—

Home computing is growing up - fast. Back six months ago, we were predicting a million computers in American homes by 1980, and no one believed us. Well - it looks like we were wrong.... It's going to be a lot more than a million.

We may have been amongst the first to realise the implications of MITS Altair and to take positive action to play in a new ball game, but we certainly aren't alone now. There are a lot of sharp minds out there and one of the sharpest belongs to a fellow called Wayne Green.

He publishes a magazine called 73, for radio hams, and has earned a reputation for running a tight ship, obtaining excellent articles and packaging them in a very professional manner. Wayne reads his mail. Hams are becoming fascinated by processors and are demanding information - Wayne decided to supply it. His market looked sufficiently substantial that he could print as many as five thousand for an initial issue. Seven weeks later, BYTE was published - fifty thousand copies and if you manage to get one, chain it to your desk.

BYTE is all that everybody hoped for - good articles in an excellent production. It fills an obvious void in that it is aimed specifically at the computer hobbyist and is the commercial market place for those selling hobby kits, systems and components. This latter is important - home computing is not just an activity of hobbyists - it's a commercial field too. Through BYTE, the hobbyist can now find and select suppliers. This is obvious, but also through BYTE the suppliers are able to communicate. This is likely to result in compatibility between products and software even to the point, for instance, of the development of recording standards for voice grade cassette systems. (We hear that Wayne is promoting a suppliers meeting in Kansas City - if you have strong views about standards, write him pronto.)

The other side of this is that BYTE will largely rely on money from advertisers. There is money to produce a fine magazine, but a strong incentive not to knock an advertiser's product. Thus there is still room for a variety of publications. As needs become identifiable, they will emerge, probably from some of the club or users group newsletters which are mushrooming across the nation. At the moment , we see Hal Singer's Micro-8 Newsletter and Lee Felsenstein's Journal of Community Communications showing the most potential. PCC will continue to be principally concerned with educational and 'people' uses of computers - a source of ideas and a directory to more specialist publications. This latter function - a directory- is certainly needed. The bill for infomation is becoming pretty steep, $70-80 will buy subscriptions to most of todays periodicals, but that's not a small item in a home budget. And this cost will rise with the number of clubs - there are already three in California now publishing newsletters. Since few of us can afford to buy everything: PCC will publish reviews and reprints of significant articles.

BYTE magazine is published monthly by Green Publishing, Inc., Peterborough, New Hampshire 03458. Subscription rates are $12 for one year worldwide. Two years, $22. Three years, $30. Second class postage application pending at Peterborough, New Hampshire 03458 and at additional mailing offices. Phone: 603-924-3873. Entire contents copyright 1975 by Green Publishing, Inc., Peterborough, NH 03458. Address editorial correspondence to Editor, BYTE, Box 378, Belmont MA 02178. From inception to press in seven weeks — surely a magazine creation record. Guinness please take notice.

Club magazines - worthwhile articles but much space is, naturally given to the doings of members. To date the heavyweight is *Interface* which comes punched for 3 hole binder.

Homebrew Computer Club Newsletter
P.O. Box626
Mountain View, Ca. 94040
no set price/donation

Interface
11557 Sunshine Terrace
Studio City, Ca. 91604
$10/yr.

BITS & PIECES
San Diego Computing Society
Gary Mitchell
Box 35
Chula Vista, Ca. 92012
$2.50/yr.

The home computer world can be loosely divided into three parts - those who process information, those who move information (eg. Hams) and those who store and retrieve it. This is the magazine for those who see the importance of a library in its widest sense.

The Journal of Community Communications
LCG Engineering
1807 Delaware St.
Berkeley, Ca. 94703
$1/issue

The Digital Group appears to be becoming just another commercial kit source, but there is nevertheless much of interest in their publication for the experienced kit-builder.

The Digital Group Clearinghouse
Box 6528
Denver, Co. 80209
$6/yr

Academic in tone, well written, lengthy articles. The place to look for in depth treatment.

Computer Hobbyist
P.O. Box 295
Cary, N.C. 27511
$6/yr

Hard dense info for hard but not dense hobbyists. Is the premier source of 8 bit technical information, particularly hardware, and almost the sole source for 8008 goodies!

Micro - 8 Newsletter
Cabrillo Computer Center
4350 Constellation
Lompoc, Ca. 93436
$6/yr

This is the magazine of the Altair users group, but it has articles deserving of a much wider audience. If you can't get a copy from MITS - find someone with an Altair and borrow it.

Computer Notes
MITS
P.O. Box 8636
Albuquerque, N.M. 87108
comes with an Altair

DESIGN NOTES FOR TINY BASIC

by Dennis Allison, happy Lady ,& friends

SOME MOTIVATIONS

A lot of people have just gotten into having their own computer. Often they don't know too much about software and particularly systems software, but would like to be able to program in something other than machine language. The TINY BASIC project is aimed at you if you are one of these people. Our goals are very limited--- to provide a minimal BASIC-like language for writing simple programs. Later we may make it more complicated, but now the name of the game is **keep it simple**. That translates to a limited language (no floating point, no sines and cosines, no arrays, etc.) and even this is a pretty difficult undertaking.

Originally we had planned to limit ourselves to the 8080, but with a variety of new machines appearing at very low prices, we have decided to try to make a portable TINY BASIC system even at the cost of some efficiency. Most of the language processor will be written in a pseudo language which is good for writing interpreters like TINY BASIC. This pseudo language (which interprets TINY BASIC) will then itself be implemented interpretively. To implement TINY BASIC on a new machine, one simply writes a simple interpreter for this pseudo language and not a whole interpreter for TINY BASIC.

We'd like this to be a participatory design project. This sequence of design notes follows the project which we are doing here at PCC. There may well be errors in content and concept. If you're making a BASIC along with us, we'd appreciate your help and your corrections.

Incidentally, were we building a production interpreter or compiler, we would probably structure the whole system quite differently. We chose this scheme because it is easy for people to change without access to specialized tools like parser generator programs.

THE TINY BASIC LANGUAGE

There isn't much to it. TINY BASIC looks like BASIC but all variables are integers There are no functions yet (we plan to add RND, TAB, and some others later). Statement numbers must be between 1 and 255 so we can store them in a single byte. LIST only works on the whole program. There is no FOR-NEXT statement. We've tried to simplify the language to the point where it will fit into a **very** small memory so impecunious. tyros can use the system.

The language design was done in consultation with the PCC Dragon. We asked him what he had to have to write a useful program, then we took some of it away. Some other things (computed GOTO labels, for example) come free with our proposed implementation and might be useful.

The boxes shown define the language. The guide gives a quick reference to what we will include. The formal grammar defines **exactly** what is a legal TINY BASIC statement. The grammar is important because our interpreter design will be based upon it.

A SIMPLE TINY BASIC PROGRAM

```
10Ø   PRINT "POWERS"
11Ø   INPUT N
12Ø   PRINT N*N, N*N*N
13Ø   IF N<>Ø THEN GOTO 11Ø
14Ø   END
```

IT'S ALL DONE WITH MIRRORS------ OR HOW TINY BASIC WORKS

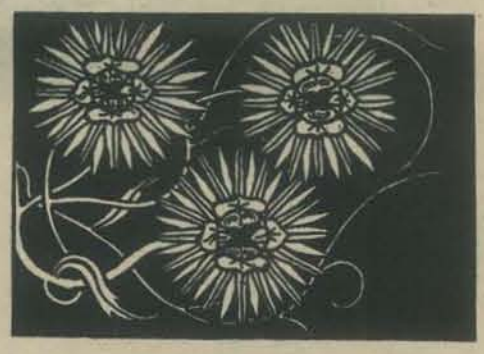
All the variables in TINY BASIC: the control information as to which statement is presently being executed and how the next statement is to be found, the returnaddressesof active GOSUBS-----all this information constitutes the **state** of the TINY BASIC interpreter.

There are several procedures which act upon this state. One procedure knows how to execute any TINY BASIC statement. Given the starting point in memory of a TINY BASIC statement, it will execute it changing the state of the machine as required. For example,

100 LET S = A+6 (cr)

would change the value of S to the sum of the contents of the variable A and the interger 6, and sets the next line counter to whatever line follows 100, if the line exists.

A second procedure really controls the interpretation process by telling the line interpreter what to do. When TINY BASIC is loaded, this control routine performs some initialization, and then attempts to read a line of information from the console. The characters typed in are saved in a buffer, LBUF. It first checks to see if there is a leading line number. If there is, it incorporates the line into the program by first deleting the line with the same line number (if it is present) then inserting the new line if it is of nonzero length. If there is no line number present, it attempts to execute the line directly. With this strategy, all possible commands, even LIST and CLEAR and RUN are possible inside programs. Suicidal programs are also certainly possible.



IMPLEMENTATION STRATGIES AND ONIONS

When you write a program in TINY BASIC there is an **abstract machine** which is necessary to execute it. If you had a compiler it would make in the machine language of your computer a program which emulates that abstract machine for your program. An **interpreter** implements the abstract machine for the entire language and rather than translating the program once to machine code it translates it dynamically as needed. Interpreters are programs and as such have their's as abstract machines. One can find a better instruction set than that of any general purpose computer for writing a particular interpreter. Then one can write an interpreter to interpret the instructions of the interpreter which is interpreting the TINY BASIC program. And if your machine is microprogrammed (like PACE), the machine which is interpreting the interpreter interpreting the interpreter interpreting BASIC is in fact interpreted.

TINY BASIC GRAMMAR

The things in **bold face** stand for themselves. The names in lower case represent classes of things. '::=' is read 'is defined as'. The asterisk denotes zero or more occurances of the object to its immediate left. Parenthesis group objects. ϵ is the empty set. | denotes the alternative (the exclusive-or).

```
line::= number statement (cr) | statement (cr)
statement::= PRINT expr-list
             IF expression relop expression THEN statement
             GOTO expression
             INPUT var-list
             LET var = expression
             GOSUB expression
             RETURN
             CLEAR
             LIST
             RUN
             END
expr-list::= (string | expression) ( , (string | expression) *)
var-list::= var (, var)*
expression::= (+|-|ϵ) term ( (+|-) term)*
term::= factor ( (* | /) factor)*
factor::= var | number | (expression)
var::= A |B |C ... |Y |Z
number::= digit digit*
digit::= 0| 1 | 2 |... | 8 |9
relop::=< (>| = | ϵ) | >(<| = | ϵ) | =
```

A **BREAK** from the console will interrupt execution of the program.

QUICK REFERENCE GUIDE FOR TINY BASIC

LINE FORMAT AND EDITING

- Lines without numbers executed immediately
- Lines with numbers appended to program
- Line numbers must be 1 to 255
- Line number alone (empty line) deletes line
- Blanks are not significant, but key words must contain no unneeded blanks
- '←' deletes last character
- X^C deletes the entire line

EXECUTION CONTROL

CLEAR delete all lines and data
RUN run program
LIST list program

EXPRESSIONS

Operators

Arithmetic		Relational	
+	−	>	>=
*	/	<	<=
		=	<>,><

Variables
A.....Z (26 only)

All arithmetic is modulo 2^{15}
(±32762)

INPUT / OUTPUT

```
PRINT X,Y,Z
PRINT 'A STRING'
PRINT 'THE ANSWER IS'
INPUT X
INPUT X,Y,Z
```

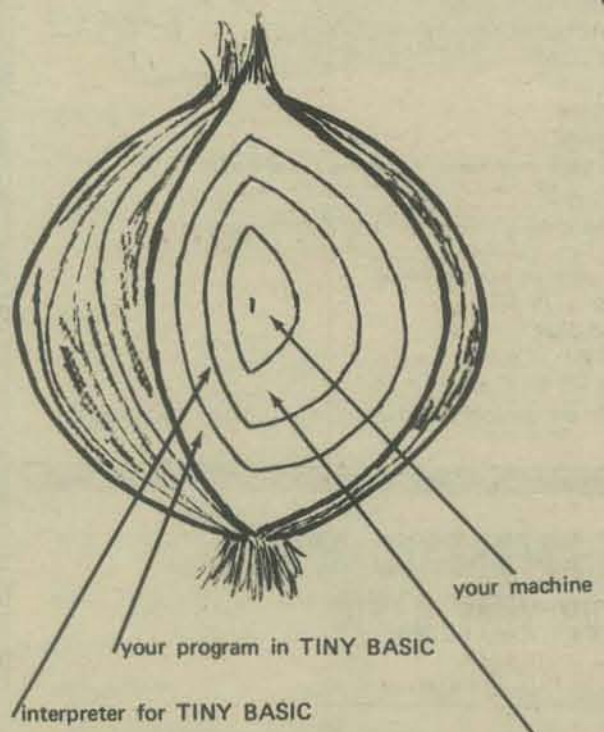
ASSIGNMENT STATEMENTS

```
LET X=3
LET X= -3+5*Y
```

CONTROL STATEMENTS

```
GOTO X+10
GOTO 35
GOSUB X+35
GOSUB 50
RETURN
IF X>Y THEN GOTO 30
```

This multilayered, onion-like approach gains two things: the interpreter for the interpreter is smaller and simpler to write than an interpreter for all of TINY BASIC, so the resultant system is fairly portable. Secondly, since the major part of the TINY BASIC is programmed in a highly memory efficient, tailored instruction set, the interpreted TINY BASIC will be smaller than direct coding would allow. The cost is in execution speed, but there is not such a thing as a free lunch.



LINE STORAGE

The TINY BASIC program is stored, except for line numbers, just as it is entered from the console. In some BASIC interpreters, the program is translated into an intermediate form which speeds execution and saves space. In the TINY BASIC environment, the code necessary to provide the transformation would easily exceed the space saved.

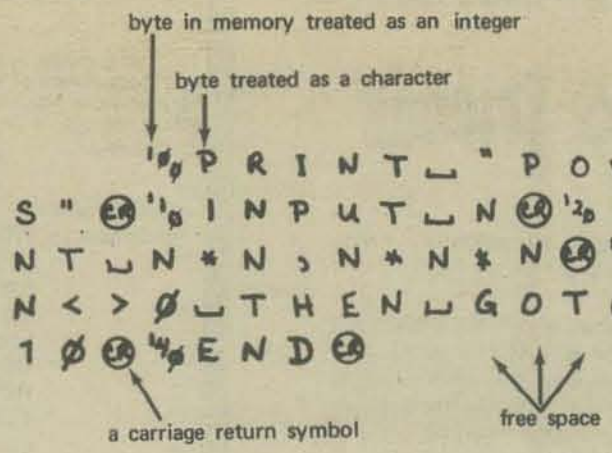
When a line is read in from the console device, it is saved in a 72-byte array called **LBUF** (Line BUFfer). At the same time, a pointer, **CP**, is maintained to indicate the next available space in LBUF. Indexing is, of course, from zero.

Delete the leading blanks. If the string matches the BASIC line, advance the cursor over the matched string and execute the next IL instruction. If the match fails, continue at the IL instruction labeled lbl.

The TINY BASIC program is stored as an array called **PGM** in order of increasing line numbers. A pointer, **PGP**, indicates the first free place in the array. PGP=0 indicates an empty program; PGP must be less than the dimension of the array PGM. The PGM array must be reorganized when new lines are added, lines replaced, or lines are deleted.

Insertion and deletion are carried on simultaneously. When a new line is to be entered, the PGM array searches for a line with a line number greater than or equal to that of the new line. Notice that lines begin at PGM (0) and at PGM (j+1) for every j such that PGM (j)=[carriage return]. If the line numbers are equal, then the length of the existing line is computed. A space equal to the length of the new line is created by moving all lines with line numbers greater than that of the line being inserted up or down as appropriate. The empty line is handled as a special case in that no insertion is made.

TINY BASIC AS STORED IN MEMORY



ERRORS AND ERROR RECOVERY

There are two places that errors can occur. If they occur in the TINY BASIC system, they must be captured and action taken to preserve the system. If the error occurs in the TINY BASIC program entered by the user, the system should report the error and allow the user to fix his problem. An error in TINY BASIC can result from a badly formed statement, an illegal action (attempt to divide by zero, for example), or the exhaustion of some resource such as memory space. In any case, the desired response is some kind of error message. We plan to provide a message of the form:

! mmm AT nnn

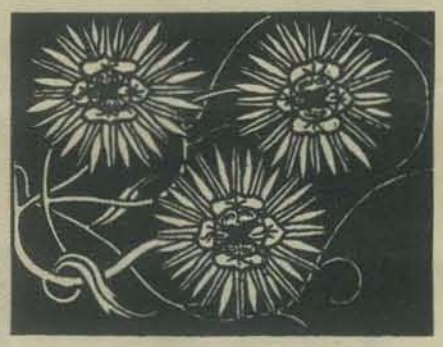
where mmm is the error number and nnn is the line number at which it occurs. For direct statements, the form will be:

! mmm

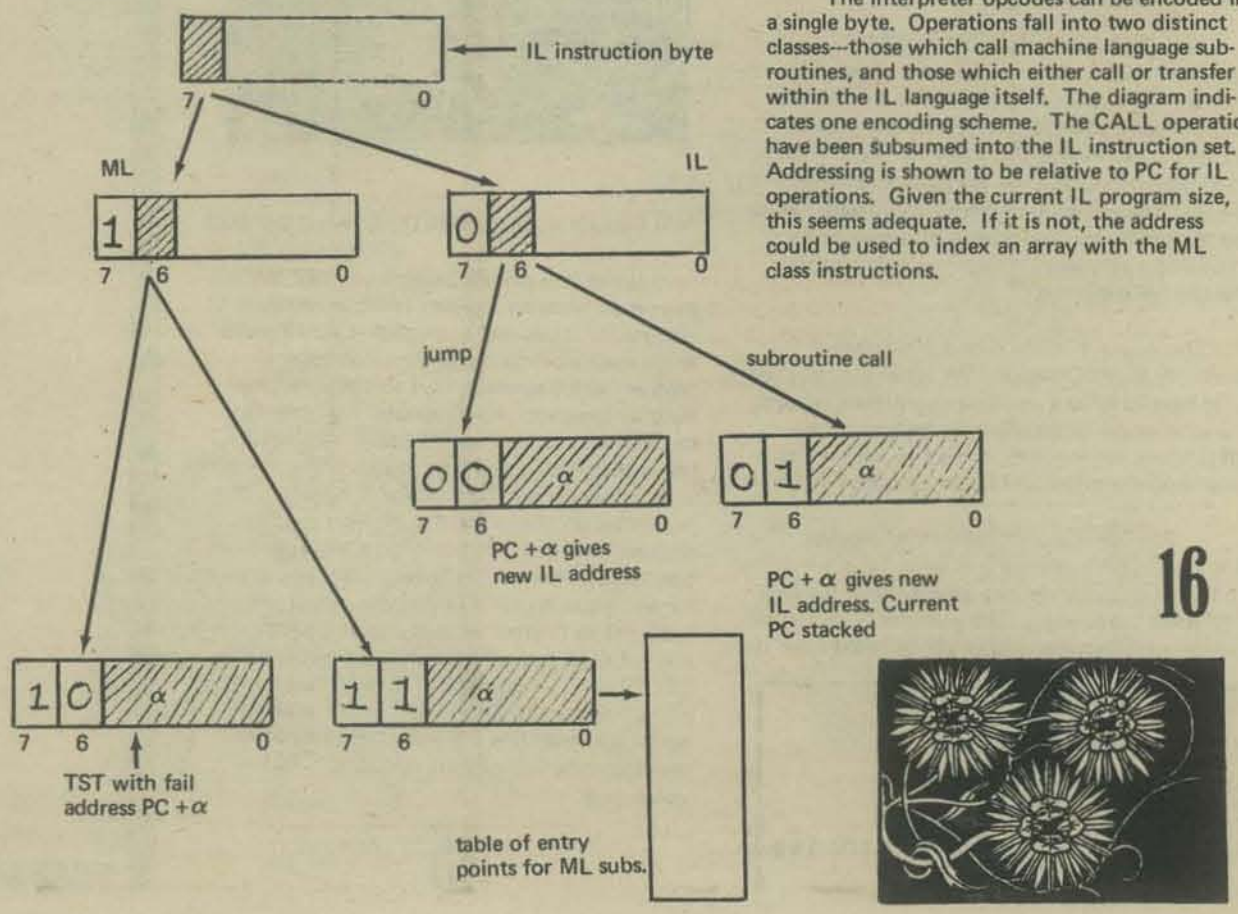
since there is no line number.

Some error indications we know we will need are:

1 Syntax error
2 Missing line
3 Line number too large
4 Too many GOSUBs
5 RETURN without GOSUB
6 Expression too complex
7 Too many lines
8 Division by zero



ONE POTENTIAL IL ENCODING



THE BASIC LINE EXECUTOR

The execution routine is written in the interpretive language, IL. It consists of a sequence of instructions which may call subroutines written in IL, or invoke special instructions which are really subroutines written in machine language. Two different things are going on at the same time. The routines must determine if the TINY BASIC line is a legal one and determine its form according to the grammar; secondly, it must call appropriate action routines to execute the line. Consider the TINY BASIC statement:

GOTO 100

At the start of the line, the interpreter looks for BASIC key words (LET, GO, IF, RETURN, etc.) In this case, it finds GO, and then finds TO. By this time it knows that it has found a GOTO statement. It then calls the routine EXPR to obtain the destination line number of the GOTO. The expression routine calls a whole bunch of other routines, eventually leaving the number 100 (the value of the expression) in a special place, the top of the arithmetic expression stack. Since everything is legal, the XFER operator is invoked to arrange for the execution of line 100 (if it exists) as the next line to be executed.

Each TINY BASIC statement is handled similarly. Some procedural section of an IL program corresponds to tests for the statement structure and acts to execute the statement.

ENCODING

There are a number of different considerations in the TINY BASIC design which fall in this general category. The problem is to make efficient use of the bits available to store information without loosing out by requiring a too complex decoding scheme.

In a number of places we have to indicate the end of a string of characters (or else we have to provide for its length somewhere). Commonly, one uses a special character (NUL = 00H for example) to indicate the end. This costs one byte per string but is easy to check. A better way depends upon the fact that ASCII code does not use the high order bit; normally it is used for parity on transmission. We can use it to indicate the end (that is, last character) of a string. When we process the characters we must AND the character with 07FH to scrub off the flag bit.

The interpreter opcodes can be encoded into a single byte. Operations fall into two distinct classes---those which call machine language subroutines, and those which either call or transfer within the IL language itself. The diagram indicates one encoding scheme. The CALL operations have been subsumed into the IL instruction set. Addressing is shown to be relative to PC for IL operations. Given the current IL program size, this seems adequate. If it is not, the address could be used to index an array with the ML class instructions.

PC + α gives new IL address. Current PC stacked

TINY BASIC INTERPRETIVE OPERATIONS

TST lbl, 'string'	delete leading blanks If string matches the BASIC line, advance cursor over the matched string and execute the next IL instruction. If a match fails, execute the IL instruction at the labeled lbl.
CALL lbl	Execute the IL subroutine starting at lbl. Save the IL address following the CALL on the control stack.
RTN	Return to the IL location specified by the top of the control stack.
DONE	Report a syntax error if after deletion leading blanks the cursor is not positioned to read a carriage return.
JMP lbl	Continue execution of IL at the label specified.
PRS	Print characters from the BASIC text up to but not including the closing quote mark. If a cr is found in the program text, report an error. Move the cursor to the point following the closing quote.
PRN	Print number obtained by popping the top of the expression stack.
SPC	Insert spaces to move the print head to next zone.
NLINE	Output CRLF to Printer.
NXT	If the present mode is direct (line number zero), then return to line collection. Otherwise, select the next sequential line and begin interpretation.
XFER	Test value at the top of the AE stack to be within range. If not, report an error. If so, attempt to position cursor at that line. If it exists, begin interpretation there; if not report an error.
SAV	Place present line number on SBRSTK. Report overflow as error.
RSTR	Replace current line number with value on SBRSTK. If stack is empty, report error.
CMPR	Compare AESTK(SP), the top of the stack, with AESTK(SP-2) as per the relation indicated by AESTK(SP-1). Delete all from stack. If condition specified did not match, then perform NXT action.
INNUM	Read a number from the terminal and push its value onto the AESTK.
FIN	Return to the line collect routine.
ERR	Report syntax error and return to line collect routine.
ADD	Replace top two elements of AESTK by their sum.
SUB	Replace top two elements of AESTK by their difference.
NEG	Replace top of AESTK with its negative.
MUL	Replace top two elements of AESTK by their product.
DIV	Replace top two elements of AESTK by their quotient.
STORE	Place the value at the top of the AESTK into the variable designated by the index specified by the value immediately below it. Delete both from the stack.
TSTV lbl	Test for variable (i.e. letter) if present.. Place its index value onto the AESTK and continue execution at next suggested location. Otherwise, continue at lbl.
TSTN lbl	Test for number. If present, place its value onto the AESTK and continue execution at next suggested location. Otherwise, continue at lbl.
IND	Replace top of stack by variable value if indexes.
LST	list the contents of the program area.
INIT	Performs global initialization Clears program area, emptys GOSUB stack, etc.
GETLINE	Input a line to LBUF.
TSTL lbl	After editing leading blanks, look for a line number. Report error if invalid; transfer to lbl if not present.
INSRT	Insert line after deleting any line with same line number.
XINIT	Perform initialization for each stated execution. Empties AEXP stack.

A STATEMENT EXECUTOR WRITTEN IN IL

This program in IL will execute a TINY BASIC statement. The operators TST, TSTV, TSTN, and PRS all use a cursor to find characteristics of the TINY BASIC line. Other operations (NXT, XPER) move the cursor so it points to another TINY BASIC line.

THE IL CONTROL SECTION

```
START:  INIT                    ;INITIALIZE
        NLINE                   ;WRITE CR/LF
CO:     GET LINE                ;WRITE PROMPT & GET A LINE
        TSTL    XEC             ;TEST FOR LINE NUMBER
        INSRT                   ;INSERT IT (MAY BE DELETE)
        JMP     CO
STMT:   XINIT                   ;INITIALIZE FOR EXECUTION
```

STATEMENT EXECUTOR

```
STMT:   TST     S1,'LET'        ;IS STATEMENT A LET?
        ISTV    S16             ;YES. PLACE VAR ADDRESS ON AESTK.
        CALL    EXPR            ;PLACE EXPR VALUE ON AESTK.
        DONE                    ;REPORT ERROR IF cr NOT NEXT.
        STORE                   ;STORE RESULT.
        NXT                     ;AND SEQUENCE TO NEXT.
S1:     TST     S3,'GO'         ;GOTO OR GOSUB?
        TST     S2,'TO'         ;YES ...TO OR ...SUB.
        CALL    EXPR            ;GET LABEL.
        DONE                    ;ERROR IF cr NOT NEXT.
        XPER                    ;SET UP AND JUMP.
S2:     TST     S14,'SUB'       ;ERROR IF NO MATCH.
        CALL    EXPR            ;GET DESTINATION.
        DONE                    ;ERROR IF cr NOT NEXT.
        SAV                     ;SAVE RETURN LINE.
        XFER                    ;AND JUMP.
S3:     TST     S8,'PRINT'      ;PRINT.
S4:     TST     S7,'"'          ;TEST FOR QUOTE.
        PRS                     ;PRINT STRING.
S5:     TST     S6,','          ;IS THERE MORE?
        SPC                     ;SPACE TO NEXT ZONE.
        JMP     S4              ;YES, JUMP BACK.
S6:     DONE                    ;NO, ERROR IF NO cr.
        NLINE
        NXT
S7:     CALL    EXPR            ;GET EXPR VALUE.
        PRN                     ;PRINT IT.
        JMP     S5              ;IS THERE MORE?
S8:     TST     S9,'IF'         ;IF STATEMENT.
        CALL    EXPR            ;GET EXPRESSION.
        CALL    RELOP           ;DETERMINE OPR AND PUT ON STK.
        CALL    EXPR            ;GET EXPRESSION.
        CMPR                    ;PERFORM COMPARISON—PERFORMS NEXT IF FALSE.
        JMP     STMT            ;GET NEXT STATEMENT.
S9:     TST     S12,'INPUT'     ;INPUT STATEMENT.
S10:    CALL    VAR             ;GET VAR ADDRESS.
        INNUM                   ;MOVE NUMBER FROM TTY TO AESTK.'
        STORE                   ;STORE IT.
        TST     S11,','         ;IS THERE MORE?
        JMP     S10             ;YES.
S11:    DONE                    ;MUST BE cr.
        NXT                     ;SEQUENCE TO NEXT.
S12:    TST     S13,'RETURN'    ;RETURN STATEMENT.
        DONE                    ;MUST BE cr.
        RSTR                    ;RESTORE LINE NUMBER OF CALL.[
        NXT                     ;SEQUENCE TO NEXT STATEMENT.
S13:    TST     S14,'END'
        FIN
S14:    TST     S15,'LIST'      ;LIST COMMAND.
        DONE
        LST
        NXT
S15:    TST     S16,'RUN'       ;RUN COMMAND.
        DONE
        NXT
S16:    TST S17,'CLEAR'         ;CLEAR COMMAND.
        DONE
        JMP START

S17:    ERR                     ;SYNTAX ERROR.

EXPR:   TST     E0,'–'
        CALL    TERM            ;TEST FOR UNARY –.
        NEG                     ;GET VALUE.
        JMP     E1              ;NEGATE IT.
E0:     TST     E1,'+'          ;LOOK FOR MORE.
        CALL    TERM            ;TEST FOR UNARY +.
E1:     TST     E2,'+'          ;LEADING TERM.
        CALL    TERM            ;SUM TERM.
        ADD
        JMP     E1
E2:     TST     E3,'–'          ;ANY MORE?
        CALL    TERM            ;DIFFERENCE TERM.
        SUB
        JMP     E3
E3: T2: RTN                     ;ANY MORE?
```

```
TERM:   CALL    FACT
TO:     TST     T1,'*'
        CALL    FACT    ;PRODUCT FACTOR.
        MPY
        JMP     TO
T1 :    TST     T2,'/'  ;ANY MORE?
        CALL    FACT    ;QUOTIENT FACTOR.
        DIV
        JMP     TO

FACT:   TSTV    FO      ;VARIABLE.
        IND             ;YES, GET THE VALUE.[
        RTN
F0:     TSTN    F1      ;NUMBER, GET ITS VALUE.
        RTN
F1:     TST     F2,'('  ;PARENTHESIZED EXPR.
        CALL    EXPR
        TST     F2,')'  ;MATCHING PARENTHESIS.
        RTN
F2:     ERR             ;ERROR.

RELOP:  TST     RO,'='
        LIT     0       ;=
        RTN
RO:     TST     R4,'<'
        TST     R1,'='
        LIT     2       ;<=
        RTN
R1:     TST     R3,'>'
        LIT     3       ;<>
        RTN
R3:     LIT     1       ;<
        RTN
R4:     TST     S17,'>'
        TST     R5,'='
        LIT     5       ;>=
        RTN
R5:     TST R6,'<'
        LIT 3           ;<>
R6:     LIT 4           ;>
        RTN
```

WE'RE NOT DONE YET

This isn't everything one needs to make a TINY BASIC. It's just a beginning and **nothing** is tested yet. We'll have more next issue. In the meantime, we welcome your comments, ideas, letters, and corrections.

TINY BASIC LETTERS

PCC---

I enjoyed reading your magazine. Although I am hardware oriented, and, perhaps, into more control-type applications, the Altair 8800 music software was precious. What good is a lot of silicon if it can't sing? My guess is that 8800's will become so popular that you might shift away from HP BASIC towards 8800 software. In any event, here's my subscription.

Two further comments:

1) I am opposed to using PCC as a distributor of saleable (ie, not free!) software between subscribers. Monies should go for the betterment of the organization, so that our common interests are served.

2) I have built a number of interfaces for my Altair and I'm sure others have. My designs need no fancy test equipment to debug and cost very few bucks. Do you think your readers would be receptive to feature articles about them? **(Yes!)**

Mark Gelfand
19 Eliot St. 2
Jamaica Plain, MA
02130

• • •

You appear to make the same mistake that all educationalists make – underestimating kids. As soon as kid who is manipulating a machine in BASIC divides one by anything and gets zero they'll be so pissed off they'll lose interest. How do you expect a kid to learn if the machine can't show them what happens. They don't need much accuracy in their figures but at least they should know what happens when they do things differently.

I'd like to help in a sort of ephemeral way; I arrived at computing from teaching – I love teaching kids – the smaller the better and I'll go back to it sometime. But first I want to sort out the computer because it can help. Your ideas for a hard wired BASIC is fantastic but for the problem of I/O which might not be standardized. Perhaps dummy status and buffer locations as in DEC 11's would be an idea – anyway it'll happen because it'll be perfect for school and I'd like to get it happening here in England. Perhaps someone could send me details of the Intel chip and the instruction set. Perhaps I could play with a mini floating point package or fixed point.

All these are perhaps because I've only just discovered PCC and there doesn't appear to be much like it in England.

Anyway, I'll try writing (using your tiny – integer only) BASIC programs and send them.

Thank god you included GOSUB – kids love building bricks.

Mel Pullen
64 Muswell Rd.
London N10, England

• • •

About your Do-It-Yourself BASIC: I have about 100 pages of BASIC block diagrams a friend of mine got from Kiewit Computing Center at Dartmouth. If you can use them, I can either get you a copy or send my copy to you for you to copy. The flowcharts are designed for a single address computer with Accumulator and Quotient registers, but with no indexing or indirect addressing, so it might be just what is needed for home-brew types.

Stephen Ketcham
Academic Computing Center
University of Vermont
Burlington, VT. 05401

Dear Mr. Allison;

A friend of mine gave me a copy of PCC magazine; I am now in the process of entering my subscription. In the magazine, I noticed your advertisement for "Building Your Own Basic," by Dennis Allison and others. I am really excited about it. Did you get started yet on the series? If so, I would like to try to obtain all issues. Have you written any books on the subject? Are you discussing the strategies of using a lexical analyzer, translator, or interpreter?

The BASIC language should have the following functions:

Modularity – ability to change building blocks
Special features package
Function s package
Floating point package
Device independence – supervisor might be too big
Device drivers – ability to add (or delete) driver
Error handling
    resident fault dictionary, or
    many, many error numbers, or
    combination of above.

I have had experience with many assembly languages, various BASICs and FORTRAN. I think DEC's BASIC PLUS is the best by far. I am anxious to get started on this project.

I hope to hear from you shortly.

★

Thank you for your two letters; I didn't expect such fast answers. Dennis wrote me a long and very informative letter in regard to *Do It Yourself BASIC*.

I found a copy of the book you told me about, Donald Spencer's *Game Playing With Computers,* at the Ohio State University technical library. It has a lot of good ideas, but I wish Mr. Spencer had more of these games programmed. Perhaps he is coming out with a new textbook – I'm going to write to him. I'm ambitious, but not that ambitious! It takes a lot of time to get the more complicated games perfected.

Where are all the FORTRAN users? I can't believe they don't have any games. You printed Eric Haines' letter in Vol. 3, January 1975, of PCC asking for FORTRAN games. He received only two letters in response. I would like to see game in any language. In the future I would like to see some information on heuristic approaches for games.

I guess I had better get busy and submit a game or two. Also, I have some pictures with overprinting. Does the PCC Bookstore plan to offer source ASCII papertapes for programs and pictures? "Creative Computing" prints pictures (posters) in their magazine. One can order a copy of these posters but one can't get the source. I would like PCC to offer such a service.

Will we ever be able to get some of the old Vol. 1 and 2 issues that are sold out?

Did you ever consider printing your PCC on 8½ x 11 paper? It makes filing much easier.

James E. Rathsack
North Electric Company
P. O. Box 20345
Columbus, Ohio 43220

• • •

I would like to add my vote to all the others for the good series of articles on "Building Your Own BASIC", "Tiny BASIC" etc. I have had a Mark-8 system up and running since last fall and have not begun to fully utilize the 8008. Now with Altair and a flurry of BASIC's for 8080 based machines it looks like the only way I'll ever get a BASIC running on my 8008 is by writing it myself with your guidance.

M. Paul Farr
3723 Jackstadt
San Pedro, Ca. 90731

ALTAIR BASIC

CLAIM: Not just anybody's BASIC
FACT: Not just anybody's BASIC

BY: KEITH BRITTON
ROBERT MULLEN

MITS does a lot of expensive advertising and their machine, while it has proved basically sound, has a number of problems requiring fixes - mostly evidence of hurried development. This has led to adverse comment and skepticism regarding their BASIC. MITS has done a lot wrong regarding the 8800 - but they have done a great deal that is right, too.... and received little credit for it. The Altair has proved fundamentally sound. That is to say the faults, though irritating, have cheap fixes that are effective. (People have designed *and sold* computers that did not work and could *not* be fixed.) But not only was it what was needed at the time, it was designed to be what was needed for the future. This shows commendable foresight on the part of Ed Roberts & crew, that is obvious. Less obvious, and something for which they deserve credit which they have not received, is the fact that they were willing to pay a considerable price to provide the hobbyist with things which he did not yet know he needed. The bus, for instance, has 100 lines. This cost money directly, more connections and more expensive sockets, and indirectly in that design freedom encourages competitors. *But this philosophy has provided the hobbyist with something open ended.* Their BASIC is similar but the features which render it open ended are sufficiently powerful that they amount to an advance in the development of the language.

BASIC (which is a registered trade mark of Dartmouth College) is a comparatively new language. It was developed because no existing language was suited to its application - an easy to learn language for instructional use by beginners on time shared computers. All languages are compromises and this one gave up a great deal for what it gained. Most professionals sneered at it because of its limitations but through the efforts of a small number of enthusiasts, (among them Bob Albrecht, who is still a member of the BASIC Standards Committee) the language became widely known. The more it was known, the more apparent became its unique merits. These were sufficiently important that BASIC may already have become the most widely known computer language, and is clearly destined to dominate the computer world over the next decade. Naturally, the race is on to incorporate into BASIC the things which were given up in the original compromise, resulting in a series of dialects of the language. Where does Altair BASIC fit in? At the moment, right out there in front of the field, but to explain why, let me back up a bit.

The first machines used machine code - which was fine for machines but miserable for humans. So that humans could generate machine code without losing their minds, a language was produced which allowed us to use phrases or mnemonics to assemble machine code, called, appropriately, ASSEMBLY LANGUAGE. This allowed the programmer to use every feature built into the machine and write programs which were the smallest and/or fastest possible. But assembly language was tedious, since every little step had to be defined, and since each new computer used different machine code, programs assembled for one machine would not run on another and the programmer had to learn a new language for each machine. To get over this new languages were developed which took much more general instructions, written in a form familiar to humans, and from them *compiled* the machine code necessary to carry them out. Thus were born FORTRAN and ALGOL, both math oriented, which accepted arithmetic/algebra *like* instructions.

Note the 'like'. While they were a great advance, both languages were still more adapted to the machine than to the human. Thus, they produced comparatively efficient code, but were difficult to use and very difficult to learn. Programs, however, had become portable to the point that they often needed only minor adaption for use on a different machine. Space requirements had risen sharply. The program to *compile* code was appreciably larger than that needed to *assemble* it, though the machine code was not much bigger. COBOL soon fixed that. COBOL was produced in an unsuccessfull attempt to make a language suitable for humans, principally by the expedient of writing everything out in English. This conclusively demonstrated that the information content of 'plus' and '+' are the same; that a human is perfectly at ease with either; that such a compiler requires a horrendous amount of memory to produce even inefficient code - but contributed little else and can, for our purposes, be forgotten.

Now these latter languages were all compiler languages. A program was written in *source language* compiled into *machine code* and then run. This made it difficult to run more than one program at once, so queues developed and people got bad tempered - particularly when they had an error and had to start again from the back. This wasn't too bad in industry or business where there weren't many programmers per computer and they had sufficient experience not to make many mistakes, but in education where fifty students might be trying to get their program to run..... Educators also met another problem - programming languages were so difficult to learn that only those who were going to specialize in computer science had the time necessary.

Kemeny and Kurtz, brilliantly, solved this problem at Dartmouth College by inventing a new kind of language. Beginners All Purpose Symbolic Instruction Code was *interpretive*, not a compiler or an assembler. This meant that the BASIC source language program instead of being converted to machine code, was only slightly altered, being turned instead into a funny stuff called pseudo-code. When the time came to actually run the program, the *BASIC interpreter* looked at the first pseudo-code statement. It pulled it apart, *parsing it,* decided what operations were asked for, did them and then looked at the next pseudo-code statement (unless a jump was called for, of course), keeping going until it came to a statement which said 'end'. This had lots of disadvantages. It was deathly slow because the machine had to keep on working out what the statements meant. It was *very* limited in the things that it would allow a programmer to do and it needed a lot of memory because, when the program was run, both the program and the interpreter had to be in the machine. Despite this, it lived and prospered. The speed didn't matter too much because, even used inefficiently, computers are *fast*. The limitations were more of a problem but not critical because the language was used for education, and so did not need the sophistication of a business or scientific language. The memory requirement was no problem at all, because now lots of people could share the same space. Pseudo-code was easy to shift into and out of a machine and, so long as the machine remembered which statement it was supposed to tackle next, it could simply continue after a pause. And the pauses came about because the machine would now *time share*, sharing processor time among many users by working on one program, moving it out of the machine onto a disk memory, moving in another program and working on that, etc., etc. Alternatively, several programs could be in the same machine each in its own memory partition, all sharing the same interpreter and processor.

All this was very nice, but the true reason for the sucess of BASIC was that it suited people. They could quickly and easily learn to use it, and it was powerful enough to do interesting and useful things. But man, unfortunately, is a chronically disatisfied animal. So then he wanted the speed he had given up and a lot of the features of the other languages to be built into BASIC - and there was no way he was going to give up the things he liked.

Well, the only direct way to speed in BASIC is to compile it instead of interpreting it. This can be done but then one loses one of the nicest traits of BASIC, the ease with which one can change the program. This is only possible because of pseudo-code. Since BASIC interprets one statement at a time, it doesn't mind a bit if you slip in an extra one or delete a few, but the slightest change in a compiled program requires that the whole thing be re-compiled. But the MITS software crew have an *indirect* way to blinding speed (or, more accurately, all the speed of which the processor is capable), they allow BASIC to jump back and forth to machine code subroutines. These can be written as such, assembled or compiled. So the Altair user can simply keep a library of such routines and use them as needed.

This has been done before, as has another of Altair BASIC's major features - the ability to talk out to user-supplied I/O devices, but not as simply and not as cheaply. A BASIC with the power of this one is a major acheivement, there's a monstrous amount of work in it, and they have sold in the low kilobuck range for each copy. Some of the other features, particularly string and numeric matrix handling are certainly unusual and may actually be unique, but the user may notice them less than the general attention to detail evident in the programmers' approach. They, Bill Gates—Paul Allen—Monte Davidoff, must have spent literally hundreds of man-hours mulling over comparatively minor details - but details which sum to a degree of convenience for the user which will endear the dialect to those who are lucky enough to own an Altair. And, hopefully, the fact that MITS have done their BASIC so well will spur their competitors to improve the language yet more. Or, if they can't take a step foward, copy MITS's innovations and at least not take a step back.

All major programs must be expected to have bugs and the extent of the testing required to identify the more subtle ones is so great that it is more reasonable to test for the obvious ones and then wait for the users to find the others, updating software with fixes at intervals. Altair BASIC version 2.0 had a serious problem in that a jump out of a FOR.... NEXT loop left garbage on the stack. Do this too often and the stack would grow relentlessly down from high memory until it ate the program. This has been fixed in version 3.0, according to Paul Allen, but we have not yet received a copy to pull apart. We also hear that there have been a number of other improvements and fixes. Presumably, someone punished it a lot harder than we did, since we found little else to criticize, but we did find one problem and it has unfortunately been left in version 3.0. If you print a value less than 0.1, it appears in scientific notation. So, if you are printing out dollars and cents, and you have less than 10¢, you suddenly see some thing like — 3.00000E-02.

MITS has frozen development at the 3.0 version, except for bug fixing, and are close to releasing the first versions of their extended BASIC. And THAT has things that will make even more difference to the way BASIC will grow over the next few years. The worst single item BASIC gave up, relative to the other languages, was flexibility in precision, adopting 6 digit floating point for all variables. With floating point even incrementing by one is slow, and business use requires more precision. Altair Extended Basic is to have integer, 6 digit and extended precision variables . . . plus a lot more.

Nitty Gritty

There have been two major streams of development in BASIC, which can be broadly described as HP BASIC and DEC BASIC, the most obvious difference being multiple statements per line in the latter. MITS has followed the DEC stream and is very similar to PDP11 BASIC. Few will find much difficulty in translating listings to the new code, however, and almost all programs will become smaller.

A lot of space will be saved by the use of multiple statements per line, but the separator between statements is a colon instead of the backslash used by DEC. Just perversity? Not at all -*you don't have to shift for a colon.* This rendering of JOTTO, courtesy of Kent Cross, shows how much compression can be acheived. He is now scrunching Star Trek, but don't hold your breath - it's a lot of work!

INPUT

This saves space principally by reducing the number of line numbers which have to be stored. Another simple improvement saves a line and greatly improved clarity can be seen in lines 40,80 and 270. Mostly, when one asks for input, one also prints a line to say what input is wanted. This seems to have escaped most people but MITS noticed and allowed a print string after INPUT.

NEXT

The MITS people also noticed that space was wasted in FOR...NEXT loops. If you don't have a nested loop, you don't need to specify the variable and if you do, often you could avoid a second NEXT if you could specify more than one. It's easier on the programmer too, fewer keystrokes. (See lines 50&150.)

STRINGS

Programmers with small machines become space conscious. And to help them is a function, FRE which returns the amount of space left, or with a string argument, the free string space. The latter is in a state of constant flux in the Altair. Unlike most BASICS, with this only the total string space is defined. Any string can be up to 255 characters long, *but only the space in the strings which are filled with characters count.* And that, of course changes dynamically.

This isn't the only unusual feature of Altair strings. For one real mind blower, they can be defined as subscripted variables. Of course a 10x10 matrix of 255 character strings would need memory.....

Another nice string trick - if you need strings in DATA statements, so long as you don't need leading blanks or commas, you can type them without quotes, see lines 240&250. Think how many keystrokes that can save. One complaint though, the DEC BASIC convention is followed regarding substrings. LEFT$ & RIGHT$ can be convenient, but when one wants towork in the middle, MID$ is clumsy compared to HP BASIC's A$(5,7).

Not a complaint but PRINT USING would have been nice to have. Still, with VAL$ and STR$ one can convert from string to numeric and back, which gives a lot of control, and CHR$ allows one to specify an ASCII numbered character.

MATs

Altair BASIC has matrices, naturally, but theirs can have up to 255 dimensions.... Use three for 3D, and for time travel games..... One warning though. The MATs start from 0 not from 1. Here again is a great division (The BASIC standards committee voted 14 for 0, 14 for 1) and for the author's money MITS did this right too. HP matrices will work on the Altair, with some waste space but the reverse won't be true. Matrices, like the strings, are dynamically dimensioned, so you can work with one larger than the memory of the machine - so long as you don't ever fill it at one time!

END

As a space saver, the END statement can be left out, but this produces curious consequences. Since the machine has not been told to stop, it doesn't, and the effect is as though RUN had been typed instead.

K. Britton and B. Mullen at work

VARIABLES

Partly as a space saver, partly as a people saver, the RUN command initialises all variables to zero, so the first time a variable is used it will be initialized. One does wonder though, whether this will train people to bad habits. There is one useful consequence though. Few will feel the need to set a mess of variables to zero and be caught by trying A=B=C=D=0 or similar. Doesn't work because one of the = behaves as an assignment operator, the other becomes relational.

Yet another good idea, though unfortunately not fully implemented, is the use of datanames. In most high level languages, and assemblers for that matter, one can call a spade a spade. If you are using a variable to store a total, you can call it TOTAL. This helps the programmer to remember what goes where. In this BASIC one can call a variable FRAN, if it helps *but one must proceed with considerable caution thereafter.* Only the first two letters are checked so any later dataname using the same two will be confused. And you had best not use TOTAL at all. It contains the reserved word TO and any embedded reserved word will cause a syntax error. They are not always easy to spot *and MITS BASIC only checks for this at run time,* a serious weakness in any BASIC, *and you could find that you have to change every occurrence of a bad dataname.* So if you are starting on a long program, try the proposed datanames first!

```
10 JOHN=15:FRUMP=13:GERTRUDE=14
20 PRINT JOHN;FRUMP;GERTRUDE
30 PRINT JOE;FRANNY;GENE
40 END
OK
RUN
 15  13  14
 15  13  14

OK
```

Jotto FOR THE ALTAIR BY KENT CROSS

```
40 INPUT "DO YOU WANT INSTRUCTIONS (Y/N)";A$:IF A$="N" THEN 47
41 PRINT "THIS IS THE GAME OF JOTTO. I AM THINKING OF A"
42 PRINT "FIVE LETTER WORD. YOU TRY AND GUESS THE WORD BY"
43 PRINT "PRINTING 5-LETTER WORDS AND I'LL TELL YOU HOW "
44 PRINT "MANY LETTERS IN YOUR WORD ARE IN THE SAME POSITION"
45 PRINT "AS IN MY WORD. YOU GET 15 GUESSES.":PRINT
47 PRINT:PRINT
50 FOR X=1 TO INT(RND(8)*20)+1:READ C$:NEXT
60 RESTORE:T1=0
70 T1=T1+1:IF T1=15 THEN 230
75 T=0:Z=1
80 INPUT "YOUR WORD";A$:PRINT:IF LEN(A$)=5 THEN 110
90 IF LEN(A$)>5 THEN PRINT "ONLY 5 LETTERS LONG, PLEASE.":GOTO 80
105 PRINT "NOT";LEN(A$);"LETTERS LONG, FIVE LETTERS LONG!":GOTO 80
108 PRINT "YOU KNOW DAMN WELL THAT WORD DOESN'T EXIST!!":GOTO 75
110 FOR X=1 TO 5
120 IF MID$(A$,X,1)=MID$(A$,X+1,1) THEN Z=Z+1:IF Z=3 THEN 108
130 IF MID$(A$,X,1)=MID$(C$,X,1) THEN T=T+1:IF T=5 THEN 190
150 NEXT
160 IF T=1 THEN PRINT"YOU HAVE 1 LETTER IN THE RIGHT POSITION.":GOTO 70
170 PRINT "YOU HAVE";T;"LETTERS IN THE RIGHT POSITION.":GOTO 70
190 PRINT "YOU GUESSED IT!! AND IN ONLY";T1;"TRIES!":GOTO 270
230 PRINT "SORRY, TOO MANY GUESSES. THE WORD WAS ";C$
240 DATA INPUT,HELLO,ZEBRA,WHERE,HIVES,START,IRATE,SINKS,SENSE,PRINT
250 DATA DIGIT,APART,DRAMA,START,OPERA,RESET,BASIC,MARCH,COUNT,FAUST
270 INPUT "DO YOU WANT TO TRY AGAIN (Y/N)";A$:IF A$="Y" THEN 47
280 END
OK
```

RND

Since we haven't yet gotten version 3.0, we have not bottered to punish the random number generator and can't give an opinion on its randomness. But we can, certainly, offer an opinion of the control over it given to the user. This control will make RND useable for games, simulations and for encryption. One can give RND ( ) a positive, negative or zero arguement, The effects:

```
10 FOR X=1 TO 3
20 PRINT RND(0)
30 NEXT
40 END
RUN
 .811635
 .811635
 .811635
```

ZERO

This returns whatever number is in the random number generator — doesn't change it.

```
20 PRINT RND(-.3)
RUN
 .400015
 .400015
 .400015
```

NEGATIVE NUMBER

This changes the number in the random number generator, using the value as a seed. Same seed, same value.

```
20 PRINT RND(-.4)
RUN
 .792188
 .792188
 .792188
```

Different seed, different value.

```
20 PRINT RND(1)
RUN
 .946891
 1.70491E-02
 3.20927E-02
```

POSITIVE NUMBER

This give a new random number each time — and the value of the arguement does not matter. This is the one to use for games.

```
5 X=RND(-.3)
RUN
 .996024
 2.1321E-02
 .919327
```

For simulation you will need random numbers — But often the same sequence every time you run. So add something like this to set the random number generator to the same value each time you run.

AND NOW ENCRYPTION

Suppose you want to protect a file or make it difficult for someone to read a tape which you are going to send to a friend who has an Altair. Choose a routine like this. (Takes a character A$ and converts — set up 1000 - 1060 then gosub to 1100 for each character.)

```
1000 INPUT"PASSWORD";B$:REM GET PASSWORD
1010 FOR  X=1 TO LEN(B$):REM CONVERT TO ASCII, BUILD SEED
1020 S=S/10+ASC(MID$(B$,X)):NEXT
1030 IF S>1 THEN S=S/10:GOTO 1030:REM SET S<1
1040 S=RND(-S):REM SEED RND GENERATOR
1050 INPUT"IN OR OUT";B$:REM SET PROGRAM SWITCH
1060 S=-1:IF LEFT$(B$,1)="O" THEN S=1
1100 X=ASC(A$)+SGN(S)*INT(128*RND(.5)):REM CONVERT CHR AND CHANGE
1110 IF X>127 THEN X=X-128:REM CONVERT TO STRING AND QUIT
1120 IF X<0 THEN X=X+128
1130 A$=CHR$(X):RETURN
OK
```

OUT

INP

The two most unusual features of Altair BASIC are the ability to use machine code subroutines, and the ability to talk to data ports. The latter uses the verb OUT, which, with a decimal argument between 0 and 255, imposes
which, with two arguments between 0 and 255 decimal imposes an 8 bit pattern on a selected port. The function INP retrieves the status of any port in similar fashion.

This may seem trivial, but any machine that can be controlled by switches, or by use of a D to A converter, can now be run from an Altair using a BASIC program. With 256 ports and 8 bits per port, this represents some 2,000 switches. Enough for an organ? Washing machine? How about the cat door, using a pressure transducer, A to D converter and INP to weigh the cat and see if it is really yours?

WAIT

How do you like the thought of leaving an Altair at home watching for smoke or intruders? There is another command, WAIT, which sets the machine to watch for a bit to change on a selected input port to help your programming.

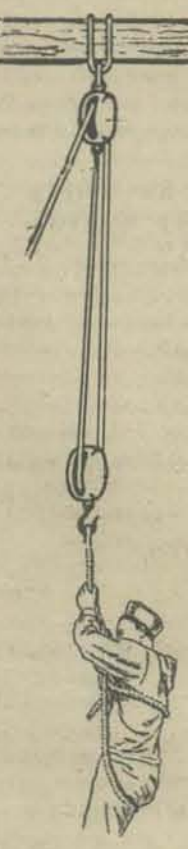
We have been using one of Bob Mullen's prototype boards at PCC. (He will be selling a relay/opto-isolator kit very shortly.) The fascination of game playing is nothing to the thrill of making a machine do something physical!

Mostly the big people in the semi-conductor world just don't want to know an individual with problems or needs, though there are good guys who are likely to help with technical data. This is one of the reasons why kits for the hobbyist have emanated from small outfits. Some of the prices have been steep but the difference between the big company prices and the little guy's have really shown where to go for value. No big company has shown any interest in selling in a market where a microcomputer starter kit can be had for around $250.

Until now.

One of the biggest, Motorola, is offering its development package for nearly half that price! For $149 you can buy the entire thing. Match this for an offer you little guys. . . .

poke



When you require a program which for some reason (speed, or special bit handling) must be written in assembly language, it becomes a task to supply the I/O and other features which are taken for granted in the high level languages. It would be great if there were a way to use the nice features of a high level language and the utility of assembly language.

Altair 8K BASIC allows the user to link his own functions into BASIC. The main steps in using an assembly language function with BASIC are: saving space in memory, putting the program in memory, and linking the program with BASIC.

When Altair 8K BASIC is loaded, it asks the question "MEMORY SIZE?". If you respond with a numeric value it is used as the top of memory for BASIC. In the example below, 7935 (17377 octal) is used. This leaves 7936 and above available for the user.

To store the program in memory, it could be loaded before or after BASIC is loaded, using a loader or using BASIC as the loader. Altair 8K BASIC has a function "POKE" which provides the ability to modify memory. Again, in the example, the user function is placed in memory in statements 210 and 230. In the same manner, data is furnished in statements 270 thru 290.

Linkage to the program is formed by putting the starting address in 117 and 120 octal; this is done in statement 160.

The example program handles octal numbers by carrying them in decimal and converting them before use, this is done by the subroutine in statements 330 thru 350.

usr

```
MEMORY SIZE? 7935
STRING SPACE?
WANT SIN-COS-TAN-ATN? N

1924 BYTES FREE

ALTAIR BASIC VERSION 2.0
[EIGHT-K VERSION]

OK
```

```
100 REM PROGRAM TO DEMONSTRATE LINKAGE TO ANOTHER PROGRAM USING BASIC
110 REM THE PROGRAM IS A VERY SLIGHTLY MODIFIED VERSION OF STEVEN
120 REM DOMPIER'S MUSIC ROUTINE.  SEE PCC VOL. 3  NO. 5  PAGE 9.
140 REM PUT THE PROGRAM STARTING ADDRESS IN USRLOC.  SEE APPENDIX U
150 REM ALTAIR BASIC REFERENCE MANUAL.
160 A=7936:I=INT(A/256):J=A-I*256:POKE 79,J:POKE 80,I
170 REM 7936 DECIMAL = 17400 OCTAL.  79 DECIMAL = 117 OCTAL
190 REM GET PROGRAM FROM DATA, CONVERT TO TRUE OCTAL, AND
200 REM STORE IN MEMORY STARTING AT 17400 OCTAL.
210 FOR N=0 TO 25:READ K:GOSUB 330
230 A=7936+N:POKE A,D:NEXT N
240 REM INPUT NOTES AND/OR TERMINATE SIGNAL FROM KEYBOARD, CONVERT
250 REM INTO TRUE OCTAL AND STORE IN MEMORY JUST ABOVE THE PROGRAM.
260 A=7968
270 INPUT K:GOSUB 330
280 IF D < 0 THEN 270
285 POKE A,D:A=A+1:IF D<>255 THEN 270
290 GOTO 450
300 REM SUBROUTINE TO CONVERT WHAT LOOKS LIKE AN OCTAL NUMBER
310 REM INTO THE CORRECT VALUE.  ALSO CHECKS FOR NUMBERS WHICH
320 REM CANNOT BE OCTAL, WHICH ARE GREATER THAN 377, OR ARE MINUS.
330 X=INT(K/100):Y=INT((K-(X*100))/10):Z=K-(X*100)-(Y*10)
340 IF K>=0 AND X<=3 AND Y<=7 AND Z<=7 THEN D=64*X+8*Y+Z:RETURN
350 D=-1:PRINT "ERROR":RETURN
370 REM PROGRAM STORED IN FAKE OCTAL IN A DATA STATMENT
380 DATA 41,40,37,176,376,377,310,26,40,5,302,16,37,106,15,302,11
390 DATA 37,25,302,11,37,54,303,3,37
400 REM ENTER HERE TO CHANGE TEMPO
410 INPUT "TEMPO" K:GOSUB 330
420 IF D<0 THEN 410
430 POKE 7944,D
440 REM RUN THE PROGRAM BY CALLING USER FUNCTION
450 W=USR(1)
460 STOP
999 END
```

Assembly Language Programming

BY: BERNARD GREENING

PCC has an Intelec 8/MOD 80. This system came with a monitor, a text-editor, and an assembler. It is Intel's system based on an 8080 chip for programming in assembly languague. NUMBERS is a BASIC program which appeared in the first issue of PCC (Vol1, no.1). By writing the same program in assembly language, the two languages can be compared.

The first step is to see what the BASIC program does. Then write down assembly language statements that do the same thing. This may take several hours or days depending on how complex the task is. This is called the source, which is then typed on the teletype using the text-editor. The text editor will then make a "computer readable" source.

The next step is to assemble the program. This is a process of converting the assembly language instructions into machine language instructions. Assembly language has labels which identify memory locations. You can branch to a labeled instruction like GOTO in Basic. You also have to set up labeled memory locations in which to store data. This is done automatically in BASIC. If you misspell anything, or if you do not follow the proper assembly language format, the assembler will indicate an error. You then have to fix your source with the text-editor and assemble it again.

Soon all your errors will be corrected. The assembler will make an object program. This consists of the machine language code which the computer can run.

The Intelec 8 monitor can load the object code and run it. If the program does not work, you can set traps called breakpoints and get a better idea of what is wrong by looking at the contents of the registers and critical memory locations.

As an example of how NUMBERS was converted from BASIC to assembly language, two lines of the program get a guess, compare it with a previously generated randon number and branch if they are equal.

```
430    INPUT G
440    IF G=X THEN 500
```

The same thing in assembly language takes four statements.

```
        CALL    DNUM            ;(A) GETS A NUMBER FROM THE TELETYPE
;
;   DOES THE RANDOM NUMBER AND THE GUESS AGREE?
;
NCHK:   LXI     H,CNUM          ;(H,L) POINTS TO THE RANDOM NUMBER
        CMP     M               ;COMPARE (A) AND ((H,L))
        JZ      WON             ;EQUAL, A WINNER
```

MONITOR:

On the Intelec 8/MOD 80, the monitor is put on 8 PROM's. It loads object programs, examines the contents of the registers and memory, puts breakpoints in programs, and branches to start programs.

ASSEMBLER:

The assembler is a program that reads a source program and creates a paper tape of the object program. It also creates a listing showing each memory location and the machine instructions that occupy them. It shows errors in your program too.

TEXT-EDITOR:

The text-editor is a program that creates and makes corrections in source programs or other text. It can insert and delete lines and make changes in lines.

The assembler converts the four assembly statements to the following machine language instructions.

```
315  270  001
041  152  000
312  117  000        (octal)
```

Each op-code like CALL, LXI, CMP, and JZ is converted to its machine language code. Labels like DNUM, CNUM, and WON are converted to the addresses that they correspond to. If changes are made in the program, the assembler will recompute the addresses as necessary. When the machine instructions are loaded in the computer, it can read through its memory, interpret the instructions, and perform the functions in NUMBERS. It generates random numbers, does input and output to the teletype, compares guesses and random numbers, and tells the user if the guess is correct.

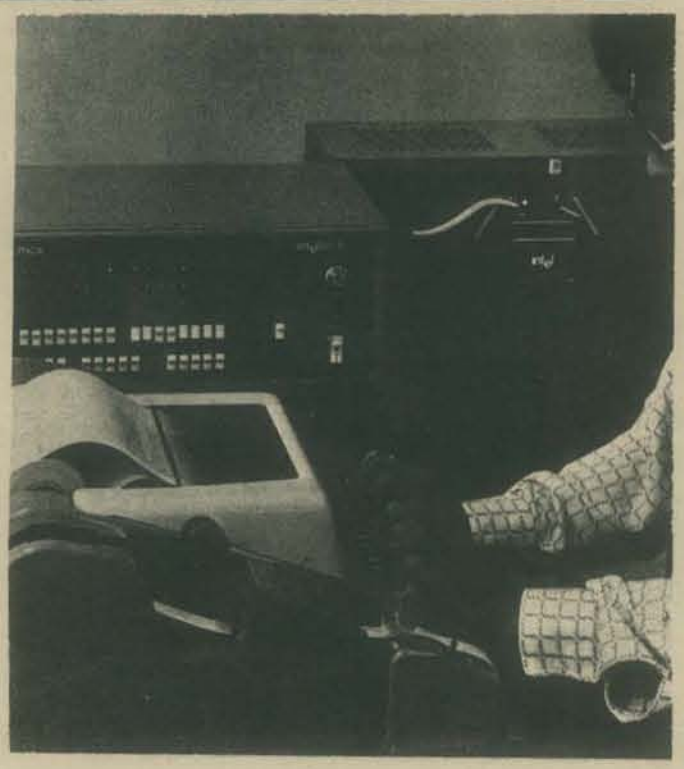
The advantage of assembly language is that it makes an object program which can be loaded and run in an ALTAIR with 1K of memory. NUMBERS takes less than 800 words in assembly language. BASIC needs 4096 or 4K words.

One way to load the object program into memory is to do it from the console keys. This requires setting about 800*8 or 6400 console keys correctly. A better method is to load a program of about 40 words which can read in NUMBERS or any other object program from paper tape and run it.

Currently, PCC has no fast, accurate method of making paper tapes. Are there enough people who are interested in loading programs from paper tape to justify our working on this? You have to have an ASR-33 or other method of reading paper tape.

We know of no "approved standard" for binary paper tape with check digits that is short and can be read into memory with a short, simple loader program. We have made one up, but would like to see if there are others. Does anyone out there know of one?

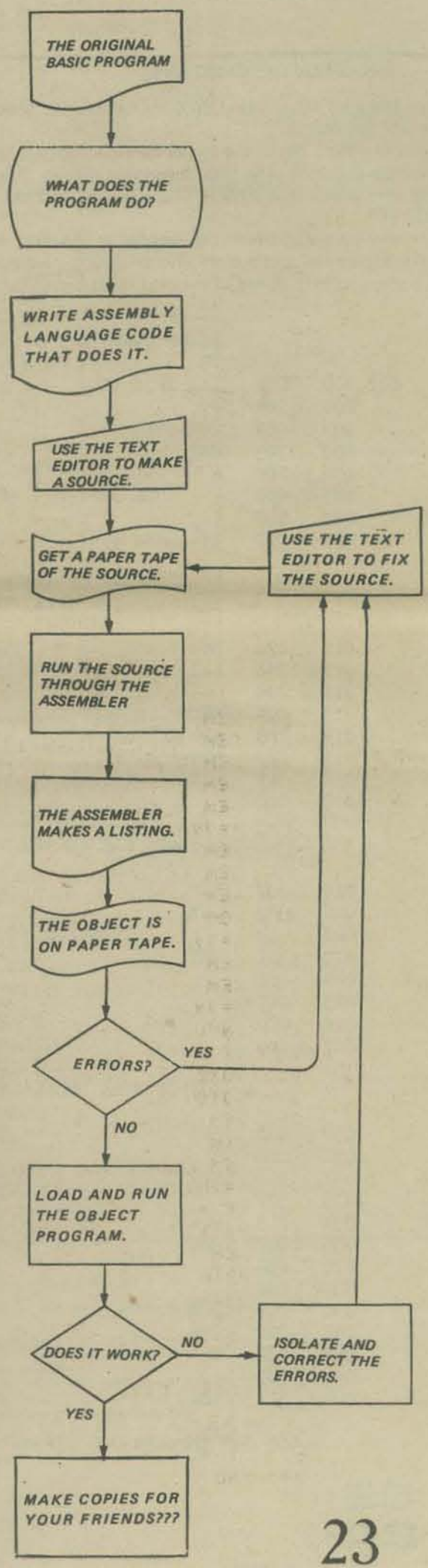
Another method of getting an object is to use a cross assembler. Cross assemblers are available on some large computers. A person with access to one can use the facilities of the larger computer to create object programs for his home computer.



****

More about Assembly Language and Numbers next time. Send some ideas!

****



LIFE on the Altair

by: Adolph P. Stumpf

In October, 1970, **SCIENTIFIC AMERICAN** *first published details about John Conway's game of* **LIFE.** *People all over the world have been discovering new and interesting* **LIFE** *patterns. They've been given names like* **GLIDER, SPACESHIP, BARBER POLE, CHESHIRE CAT, BLINKER, HARVESTER, FUSE,** *and* **BOX.**

In PCC News & New Stuff you asked for programs. Well, here is my version of John Conway's game Life. The game was described in a number of articles by Martin Gardner in the Scientific American about three years ago. Haven't come across it anywhere else.

The program was written to run on an Altair 8800 with 1K of memory and a SWTP CT-1024 terminal. With minor changes it should work with other systems using an 8080 or 8008 CPU.

At present the program is somewhat limited primarily because of small display, 16 lines of 32 characters, and lack of memory system. Computation is relatively fast, less than one half second. In comparison the display update seems agonizingly slow.

However, it's still fun to watch the display of fantastic combinations which this simple game can generate.

I'm working on some improvements which will include

1. Input of initial population and complete program control from the keyboard.
2. A 64 by 64 (or larger) character display with page selection from the keyboard.

I'll send the new version (hopefully written in BASIC) when it's finished and when I have the hardware to run it on.

PROGRAM DESCRIPTION

The program plays John Conway's game Life. Display is 30 by 15 characters on TV terminal.

Data (a generation of the initial configuration) is stored in locations 002 000 through 003 377. The first line on the display is 002 000 through 002 337, the second 002 340 through 002 377, etc. and the last line is 003 340 through 003 377.

The present generation is represented in the most significant bit; a ONE for an occupied cell and a ZERO for an unoccupied cell. The next generation is computed and stored in the next most significant bit using the same format.

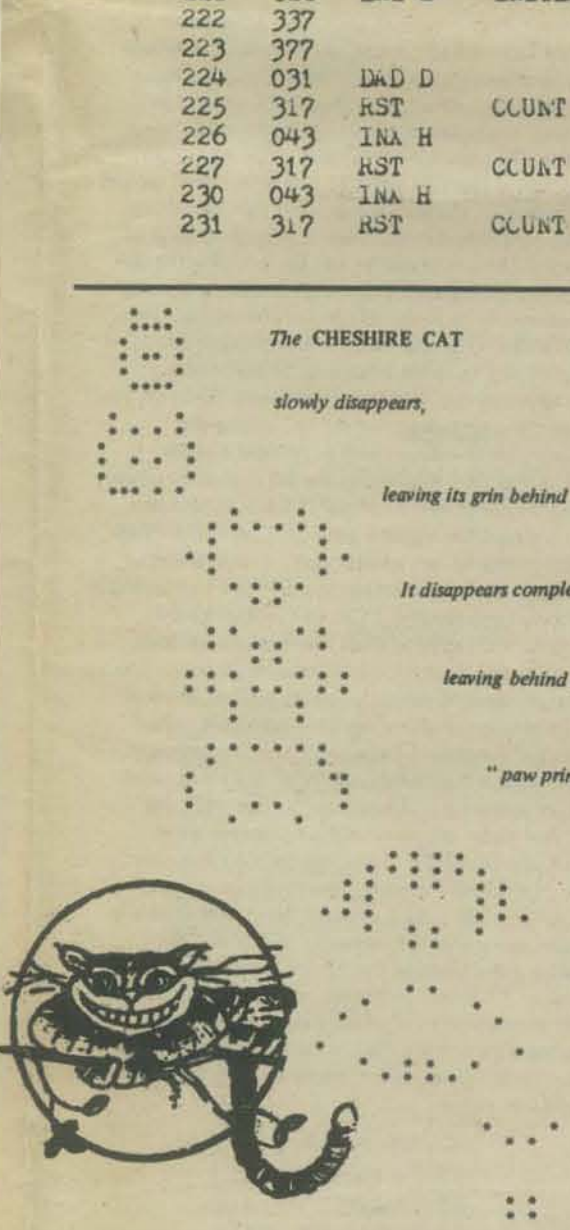
```
                    RESET START

000 000   061   LXI SP
    001   360
    002   001
    003   303   JMP
    004   100   A
    005   000
    006   000
    007   000

          SUMS NUMBER OF NEIGHBORS FOR EACH CELL,
          RETURNS WITH TOTAL IN REG B

    010   176   MOV A,M
    011   346   ANI
    012   200
    013   007   RLC
    014   200   ADD B
    015   107   MOV B,A
    016   311   RET
    017   000

          OUTPUTS ONE CHARACTER

    020   337   RST
    021   323   OUT
    022               (DEVICE NUMBER)
    023   311   RET
    024   000
    025   000
    026   000
    027   000

          OUTPUT TIME DELAY

    030   006   MVI B
    031   006
C   032   016   MVI C
    033   377
B   034   015   DCR C
    035   302   JNZ
    036   034   B
    037   000
    040   005   DCR B
    041   302   JNZ
    042   032   C
    043   000
    044   311   RET

      (000 045 through 000 077 not used)
```

TO RUN PROGRAM

1. Run program starting at location 000 315 to clear memory.
2. When HLTA light comes on, actuate STOP and RESET switches.
3. Load initial population with front panel toggle switches. Format is (octal) 3XX, where XX are "don't care" bits.
4. Initiate HOME UP and ERASE FRAME functions on terminal. Turn off cursor for a more pleasing display.
5. Run program starting at location 000 000.
6. To terminate, actuate STOP switch.

```
          OUTPUT ROUTINE, DISPLAYS 512 CHARACTERS ON TV
          FROM MEMORY LOCATIONS 002 000 THROUGH 003 377

A   000 100   021   LXI D    INITIALIZE START ADDR
        101   000
        102   002
F   103   032   LDAX D   GET DATA WORD
    104   007   RLC
    105   022   STAX D   STORE UPDATED DATA WORD FOR NEXT PASS
    106   007   RLC      DATA TO CARRY
    107   332   JC       CARRY = CELL OCCUPIED
    110   117   D
    111   000
    112   076   MVI A    CELL UNOCCUPIED, LOAD SPACE
    113   040
    114   303   JMP
    115   121   E
    116   000
D   117   076   MVI A    CELL OCCUPIED, LOAD *
    120   052
E   121   327   RST      OUTPUT CHARACTER
    122   023   INX D    INCR DATA WORD ADDR
    123   041   LXI H
    124   000
    125   374
    126   031   DAD D    CHECK FOR END
    127   322   JNC      CARRY = DONE
    130   103   F
    131   000

          CONTROL ROUTINE

    132   041   LXI H    INITIALIZE DATA STORAGE
    133   016              LINE COUNTER       = 016 @ LOC 001 373
    134   336              DATA WORD ADDR LO  = 336           374
    135   042   SHLD       DATA WORD ADDR HI  = 003           375
    136   373              CHARACTER COUNTER  = 036           376
    137   001
    140   041   LXI H
    141   003
    142   036
    143   042   SHLD
    144   375
    145   001
H   146   315   CALL     NEXT GENERATION ROUTINE
    147   214   G
    150   000
    151   346   ANI
    152   300
    153   167   MOV M,A  STORE UPDATED DATA WORD
```

```
000 154  041   LXI H
    155  374
    156  001
    157  136   MOV E,M  GET CURRENT DATA WORD ADDR
    160  043   INX H
    161  126   MOV D,M
    162  033   DCX D    DECREMENT
    163  162   MOV M,D
    164  053   DCX H
    165  163   MOV M,E  STORE UPDATED DATA WORD ADDR
    166  043   INX H
    167  043   INX H
    170  065   DCR M    DECR CHARACTER COUNTER
    171  302   JNZ      COUNTER = 0, DONE WITH LINE
    172  146   H
    173  000
    174  033   DCX D    DECR DATA WORD ADDR TWICE FOR NEW LINE
    175  033   DCX D
    176  066   MVI M    RESET CHAR COUNTER FOR NEW LINE
    177  036
    200  053   DCX H
    201  162   MOV M,D  STORE DATA WORD ADDR FOR NEW LINE
    202  053   DCX H
    203  163   MOV M,E
    204  053   DCX H
    205  065   DCR M    DECR LINE COUNTER
    206  302   JNZ      LINE COUNTER = 0, 16 LINES DONE
    207  146   H
    210  000
    211  303   JMP      GO BACK AND DO ANOTHER FRAME
    212  100   A
    213  000

         NEXT GENERATION ROUTINE, DETERMINES BIRTHS,
         SURVIVALS, AND DEATHS

G   214  257   XRA A
    215  107   MOV B,A  CLEAR REG B FOR NEW NEIGHBOR COUNT
    216  052   LHLD     GET DATA WORD ADDR
    217  374
    220  001
    221  021   LXI D    INITIALIZE MEM LOCATION OF NEIGHBOR CELL
    222  337
    223  377
    224  031   DAD D
    225  317   RST      COUNT NEIGHBOR AT TOP LEFT          K
    226  043   INX H
    227  317   RST      COUNT NEIGHBOR AT TOP
    230  043   INX H                                        J
    231  317   RST      COUNT NEIGHBOR AT TOP RIGHT

000 232  021   LXI D
    233  076
    234  000
    235  031   DAD D
    236  317   RST      COUNT NEIGHBOR AT BOTTOM LEFT
    237  043   INX H
    240  317   RST      COUNT NEIGHBOR AT BOTTOM
    241  043   INX H
    242  317   RST      COUNT NEIGHBOR AT BOTTOM RIGHT
    243  052   LHLD
    244  374
    245  001
    246  053   DCX H
    247  317   RST      COUNT NEIGHBOR AT LEFT
    250  043   INX H
    251  043   INX H
    252  317   RST      COUNT NEIGHBOR AT RIGHT
    253  053   DCX H
    254  176   MOV A,M  GET DATA WORD
    255  027   RAL      DATA TO CARRY
    256  332   JC       CARRY = CELL OCCUPIED
    257  271   I
    260  000
    261  170   MOV A,B  NUMBER OF NEIGHBORS
    262  376   CPI      ISIT 3?
    263  003
    264  312   JZ       YES, BIRTH
    265  312   J
    266  000
    267  257   XRA A
    270  311   RET      RETURN, DEATH
I   271  170   MOV A,B  NUMBER OF NEIGHBORS
    272  376   CPI      ISIT 2?
    273  002
    274  312   JZ       YES, SURVIVAL
    275  307   K
    276  000
    277  376   CPI      ISIT 3?
    300  003
    301  312   JZ       YES, SURVIVAL
    302  307   K
    303  000
    304  076   MVI A
    305  200
    306  311   RET      RETURN, DEATH
K   307  076   MVI A
    310  300
    311  311   RET      RETURN, SURVIVAL
J   312  076   MVI A
    313  100
    314  311   RET      RETURN, BIRTH

         CLEAR MEMORY ROUTINE, WRITES ZEROS IN
         LOCATIONS 002 000 THROUGH 003 377

000 315  021   LXI D
    316  000
    317  002
L   320  041   LXI H
    321  000
    322  374
    323  257   XRA A
    324  022   STAX D
    325  023   INX D
    326  031   DAD D
    327  322   JNC
    330  320   L
    331  000
    332  166   HLT
```



The **CHESHIRE CAT**

slowly disappears,

leaving its grin behind

It disappears completely

leaving behind a

"paw print"

HERE'S HOW TO PLAY *LIFE*

Births and *deaths* happen at the same time. Mark the *cells* that are to *die*. Next, mark those that are born -- you can count those that are dying. *Now you can remove the dead ones and put a mark in the new cells.*

SURVIVALS. Each *alive cell* with 2 or 3 *live neighbors* will *survive* another *generation.*

DEATHS. If a *live cell* has more than 3 *neighbors,* it dies from *OVERPOPULATION.*

If it has less than 2 *neighbors,* it dies from *isolation.*

BIRTHS. Each *empty cell* with 3 *neighbors,* no more and no less, is a *birth cell.* A mark will appear in it in the next *generation.*

REMEMBER : *Births* and *Deaths* take place simultaneously. So don't count a new *cell* for *overpopulation.*

BIBLIOGRAPHY

This is where you can go for further information.

1. Scientific American, *Oct. and Nov. 1970; Feb. and Apr. 1971 copies have an article called "mathematical games".*
2. SERIOUS GAMES: THE ART AND SCIENCE OF GAMES THAT SIMULATE LIFE, *by Clark C. Abt, published by Viking Press 1970*
3. WHAT TO DO AFTER YOU HIT RETURN; OR PCC FIRST BOOK OF COMPUTER GAMES
4. BYTE, *issues 1 and 2. See review pg.14*

MAIL

The Dragon Welcomes the Chimera

Here is the information which you asked for.

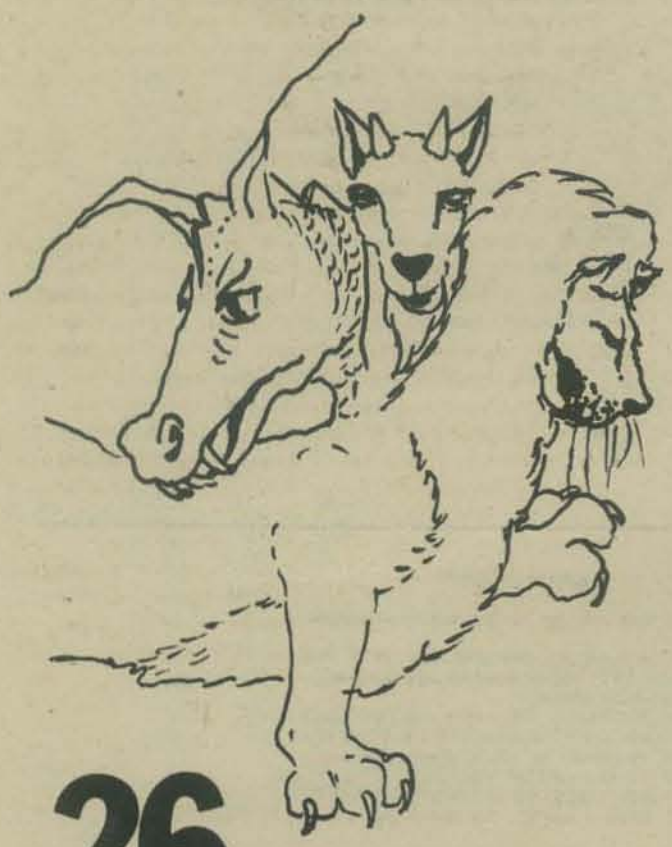
This year is the first year that we had timesharing, and languages other than FORTRAN' as well as batch facilities because of the installation of a Burroughs B5500 just before the classes began in September. I was first exposed to timesharing at the Second Conference on Computers in the Undergraduate Curriculum at Dartmouth College. Since then, the Dartmouth style has been one of my personal paradigms. (The PCC is another, Project Solo a third . . . .) Borrowing from the Dartmouth model, one faculty member offered to underwrite a prize in computing, and money obtained by selling unsolicited desk copies to a wandering used book buyer paid for two more prizes. With the special subscription rates to the PCC, we knew what we could give. The three prizes of a year's subscription to the PCC were for

(1) excellence in programming (this was won by Paul Kinney, a first year student),
(2) greatest contribution to a non-computer-science class (this was won by Craig Bock, a third year student, with his program for a course in cryptology. The program simulated the "Purple Machine" used by the Japanese in World War II), and
(3) enthusiastic support of academic computing (this was won by Debbie Campbell, a first year student).

No one knew about the contest last year, and these prizes will be formally announced on 4 September when next year's contest, with a few rules this time, will begin.

If the PCC is symbolized by the Dragon, perhaps our symbol should be the Chimera (look that up in your Funk and Wagnell's.).

John Wenzel
Assistant Professor
Department of Mathematics
Albion College
Albion, MI 49224



Resource One

PCC'ers; this is a long blurb on a San Francisco computer organization, a short blurb on Resource One is reportedly available in People's Yellow Pages. I was given approval by Resource One for PCC to publish the information below, to aid the paper, its readers, and to publicize Resource One.

Resource One is a non-profit community computer center providing the sophisticated technology of a computer to other non-profit organizations working for social change. Our current projects include the following: Computerized bookkeeping and mailing list services, information retrieval, forms processing, collecting a computerized 'library' of information on the City (e.g., property ownership, land use, census information, etc.), publishing a directory of social services available in San Francisco, and general programming and consulting to meet specific needs of user organizations.

Counting house, Resource One's bookkeeping service, is a system designed to help non-profit organizations keep their finances straight. The raw data is entered into the computer directly from the checkbooks, deposit stubs, and other original documents via a typewriter like terminal. Income statements and balance sheets can then be produced on demand. Also, lists of transactions can be provided by account , date, fund, or any combination. Currently the system handles cash disbursements, cash receipts, accounts receivable, accounts payable, payroll and general journals. The system can be used without prior knowledge of computers or bookkeeping.

NIMS, our mailing list system, is another easy-to-use system which allows someone from the user organization to type into the computer a mailing list which can then be printed out on gummed or cheshire labels. Its main advantages are that various subsets of the list can be printed, allowing an organization to target mailings to a specific audience, and that corrections to the list are easy to make. The mailing list can be sorted by either name or zip code.

ROGIRS, the Resource One Generalized Information Retrieval System, is designed to manage large amount of information through cross-indexing by 'keywords'. The text of the item is entered with keywords which describe it. The item can be pulled out of the computer by simply saying 'find' and a list of keywords, One could say 'find this or that' and II of the items with the keyword 'this' or the keyword 'that' would be found. This system is currently being used by Amnesty International to maintain a list of contacts and by the North American Congress on Latin America to research CIA involvement in Latin America.

We have done processing of client intake forms for the San Francisco neighborhood legal assistance. This involved typing into the computer the responses directly from the forms. The results were reports containing cross-tabulations of legal problems, income, ethnic grouping, etc. This program has been modified to handle other forms and could be expanded to produce correlations or other statistical reports.

The Urban Data Base Project, a collection of computerized information about the City, can be a useful tool for learning about the community and as an aid in organizing to respond to community needs. The Urban Data Base has been used by La Raza En Accion Local and the Mission Planning Council to successfully down-zone properties bordering Mission Street in San Francisco from commercial to its residential use. It has also been used by students from University California at Berkeley who are wroking with the Central City Coalition to produce an alternative 'south of Market plan' and by the Tenant's Action Group to organize housing in San Francisco.

This is a brief summay of what Resource One is doing and of the potential for what can be done. If you would like more detailed information about these projects or if we can be of assistance to your organization please do not hesitate to call. We are in Project One at 1380 Howard St., Our phone number is 'UNIT ONE' (864-8663).

Dean Kahn
224 Robin Way
Menlo Park, Ca. 94025

Intergalactic Question Man

Does Dartmouth give away/sell/trade/distribute the programs that live there? What about Lawrence Hall of Science? Anybody got any programs that they want to give away or trade? Especially games . . .

What legalities govern the using/trading/printing/copying of programs not your own? I am interested in setting up an exchange for BASIC programs, especially games. Would also like to see a book in the style of "The Whole Earth Catalog" filled with games. It would hopefully retail for $3 or $4. Something like "101 Basic Games" but with more games per dollar, and hopefully better games. I hope to eventually get your games book, but my supply of money is currently depleted.

Anybody at Datapoint want to befriend me?? I know BASIC some assembler, and have even read a booklet on Databus.

I am also looking for Grady Hicks and Jim Korp. They wrote a really neat Star Trek game that lives on the University of Texas system under the name of SPCWAR. The listing I have was listed on July 1973. Can I legally trade this program without their permission? There is also an advanced modification of this program on the United Computer Services system, Though I have not played it, I have seen a copy of the instructions, and it looks neat. Can anybody find me the address of UCS so I can try to beg a listing off them?

I am also working on version II of Spacer. I finally got the first version running, but it was too boring and serious, so I chunked it. I am in the designing and planning stage on Spacer II. It is not a standard Star Trek program, it has stuff like enemy warships that move between Quadrants, Death Rays time travel, teleporters, starmakers, smoke screens, lifeboats, a full range of experimental weapons, starships (enemy) that attack your starbases, starbases that move, blasters that allow you to shoot at all the enemy ships in your Quadrant or at only one of them, missile spreads, gravitational analomies, black holes, supernovas (and a neat way of explaining how a starship that is parsecs away can be destroyed by them), hyperspace, varying degrees of complexity selected by you, and a plot. I have tried to present a unified concept of the universe and man's place in it. Basically it is a rescue mission through enemy held territory. I have an elementary look-ahead routine which helps the enemy warships to prepare ambushes. There are also enemy scout ships in each Quadrant whose mission it is to destroy your starbases and to hinder your movement. I have about 20 commands planned so far. I would like everybodys ideas on what to put in it. What would you like it to do? Please tell me . . . it will be written in BASIC, probably HP, but I am trying to write it in as simple a BASIC as possible, and am keeping the use of strings to a minimum. It should take some time to finish, but should be finished around November. Hick's and Korp's Star Trek is written in Dartmouth BASIC — I would also like to write a graphics Spacewar on a graphics terminal that lets you draw lines. What do you think that the best system would be, letting the SR scan stay on the screen and printing the other stuff off to the side, displaying the SR scan only when it is asked for, or something else??? I would also like to write a simplified version on a CRT terminal which allows the cursor to be repositioned. I realize that most of the freakies (including myself) will be playing it on the lowly (and slowly) TTY, so I will write that version first. Can anybody tell me more about look ahead functions? Is there any Spacewar game on one of the larger systems where you play against another person (or dragon or other assorted creatures, whatever the case may be)?? Expecially one that lets you each command a fleet of ships? What are some good sources on designing and making conflict and war games? Are there any non-conflict games around? How do I join SHAFT? Have you gotten HP to loan you one of their new graphics terminals to you yet? Their publicity blurb looked good, but I would like to hear a user say something about it. Graphic CRT terminals are the wave of the future, hopefully the near future. TTYs are too slow, noisy, and eat trees. You still need some kind of hard copy device, but for running a program a CRT is hard to beat. Hey Bob, the world wants to hear more about how PCC is organized and run.

May you never run into a star,

John A. McClenny
5819 Brenda
San Antonio, TX 78240

MAIL

Star Trader

Many moons ago you sent me a listing of "Star Trader" which I promised to translate into FORTRAN IV. Well, during school I was pretty busy and was only able to make the initialization program, so during the summer, I worked on it continuously, and, at last, it's done!!! (I think) Anyway, it is enclosed.

Notes –

(1) I have added two functions besides 'save' They are 'MAP' which gives a MAP and 'HOLD' which give what is in your ship's hold.

(2) I also added to the format statement in banking to tell you how much you have on the ship.

(3) Some warnings (as in banking, selling etc.) have been removed for lack of space.

If I had the space, money would be in real numbers, as would produced goods, etc.

Eric Haines
212 N. Riding Drive
Moorestown, NJ 08057

Wanted

We would like to buy equipment that will permit operation of Wang No. 732A, flat-bed, 31" x 41" plotter, from Altair 8800.

Liss Engineering
1366 H Logan Avenue
Costa Mesa, Ca. 92626

Aquarius

Here's our request:

AQUARIUS ELECTRONICS would like to trade software, of which we have little, and biofeedback hardware, of which we have lots, for software and computer hardware. We especially are looking for a copy of the Intel 8008 assembler, the one which goes with the Intellec 8.

You asked for a book list. I'd say read, in this order "Alpha Brain Waves" or "Biofeedback," in our catalog, followed by Barbara Brown's "New Mine, New Body" and then perhaps Ornstein's "Psychology of Mind Consciousness." Tart's "Altered States of Consciousness" is heavier going, but good.

Robert M. Coppock
Customer Service
Aquarius Electronics
P. O. Bos 96
Albion, CA 95410

Even Wizards Use Computers

It would be nice to sit down at a terminal and type you a note then send it to a central computer in this city that would use shortwave to route the note to you. I just got the first part of my Altair kit and have the what do I do until it all gets here blues. I've been making a TVT terminal as per an article in Radio TV Electronics. Unfortunately the PC boards were discontinued by the time I got around to ordering them. Made them myself and have modified the terminal to use 2102's instead of the recirculating shift registers.

Got to wondering how to hook the TVT up to the Altair without an I/O board. Well it looks like two 4 to 16 line demultiplexors would form a 16 by 16 matrix that could feed 256 gates separated by diodes and then an 8 bit latch should do the job of getting everything in and out. 256 in 256 out. So what happens if you output and the output is hooked to another board of the same type. Assuming that each output connected to a device that would use the 1st byte to address 256 more bytes and then transmit the second byte well that's over 500K of output. This all leads to using the thing as a central exchange for a club. If there are two such clubs in neighboring cities several I/O's could be used as an inter city communications link. MA BELL lookout!

Enclosed is an old program that got me wasted for wasting computer time on games. Heuristic Tic-Tac-Toe. It learns from mistakes. Unfortunately there is a minor bug that bombs to monitor after 10 games. I never got to debug it.

One good program for say BASIC looks like this when ran.

```
RUN
I DON'T WANT TO
RUNNH
WHAT'S THE MATTER DON'T YOU KNOW
HOW TO SPELL RUN
```

A good version will include all the possible commands plus a control-c intterupt so you are stuck until you type the name of the program to reach the END instruction.

The MARK 8 plans show a digital to analog converter hooked onto the output part. Programs to produce waveforms are given. Better would be to latch the output into a D to A converter and then control a voltage controlled amplifier or oscillator or filter. The Altair's 256 outputs would make a jim dandy synthesizer.

Has anyone got a program to correct spelling errors? And on that subject I almost took a job at the local newspaper repairing their electronics. Far out all typewriters in the place have the same type. Time to format the paper and they feed everything into a reader that puts it all on mag tape. The IBM then uses format programs to put everything into place and then zips it off on computer controlled typesetting machines.

XANAXAN
WIZARD OF NICE NINE
Joe W. McCarty
2705 Comanche Drive
Amarillo, TX 79109

Canada 8

27

Do-It-Yourself

You asked that people who have acquired Altairs write, so here I am writing. I just completed the basic unit of the 8800 (CPU and 256 words memory) and am very impressed. The quality of the kit is as good or better than Heathkits, which is a compliment. My only criticism is the uneven presentation in the operation/theory manual. On the one hand they go into great detail about the binary system (elementary for nearly all computer nuts), but then gloss over the programming aspects of the Intel 8080. Wish they could include a few more expertly written sample programs and routines. For example, what is the best way to add two numbers in scientific notation form with 10 digit mantissas and two digit exponents?

The big news is that the school where I teach (the Harvard School in North Hollywood – independent school for boys grades 7 – 12) has taken my suggestion and ordered the Altair DOS/III system, in kit form! Yes folks, the kids and I are actually going to BUILD our own computer this summer, all for under $6K. We'll keep you posted about this project, because I think it's something many schools could and should do. Why spend many megabucks on hardware and endless maintenance agreements (we almost bought a DEC system for $70K, which means about $7K per year maintenance) when you can have the unparalled learning experience of building and caring for your own.

At the National Computer Conference, I asked the Altair people about a timesharing operating system, since we would like to have multiple simultaneous users on our school system. Their response was "Why use timesharing when each person can have his own processor for under $600?" Indeed!! So now there is a conflict in my mind, which I would appreciate having resolved through discussion/communication among computer builders/hobbyists:

THESIS: Timesharing allows multiple users, sharing a common memory (stored programs). Disadvantage is complicated operating system, and fact that a serious malfunction shuts everybody down.

ANTITHESIS: Everyone gets his own Altair 8800 with say 4K of memory and simple BASIC. One Altiar has 16K with disk for the big programs. Advantages: faster running times, and malfunctions won't shut everyone down. Disadvantage (big): inefficient use of memory (redundant operating systems), and no commonly shared data base.

POSSIBLE SOLUTION: Is there some way to multiplex several processors connected to a single large memory? Could we have several 8800's running on say 1K of internal memory but interfaced with say 20K of "common" memory? This may be an elementary computer design problem (I don't know; it seems easy enough). Is someone willing to construct such a system with the necessary software? I think it would be tremendously valuable to schools and other users.

I have enjoyed reading the newsletter very much. and would appreciate hearing from anyone who would like to communicate. As I've indicated, I'll be heavily into designing this school system, with BASIC and machine language operating systems, getting all the good games running, etc. We already have been running timeshared BASIC for five years using TTY's, acoustic couplers, and commercially purchased computer time. so we know what we're aiming for at the minimum.

Thanks again for the good work.

Gene Murrow
Harvard School
3700 Coldwater Canyon
N. Hollywood, CA 91604

MAIL

Foresight

I have been under the unfortunate impression since last year that the PCC was dead, and only through a chance encounter with the latest Datamation did I conclude that you're alive and well and living in the Bay Area.

I (or rather we) are Foresight, and while we are not as far along as you (one month formally) and not as pure (we are not non-profit) we are interested in the same kinds of things as you. Of course, since we are profit motivated we don't anticipate living off of the same kinds of things as PCC: we aim to provide business software and in the future systems for business and education. But at our (or at least my) heart, PCC has the right way. Way back, maybe in 1973, I had some thoughts about the PCC: even remember reading something by Bob in Saturday Review of Education and saying "precisely". The part of Foresight which will eventually do that kind of thing is KIDS: Kehoe Interactive Data Systems. In the Fall, we hope to have a small mini (maybe a PDP8 or even CLASSIC) to carry around in our van to demo at schools and teach intro BASIC within existing math classes. I'll keep in touch.

We are just getting into the programming business, and hence are still working at miscellaneous jobs in computers, etc. All except Macy, our salesman, who is off to Nova Scotia on his bike (I should say bicycle). When we get Macy back to town in August, maybe we'll get out there to visit. Anyway, keep up the good work.

Miles Kehoe
Macy Teetor, III
5524 Willow Street
New Orleans, LA 70115

Personal Experience

For any hobbyists out there, I can recommend the following from personal experience:

Machine Language Programming for the 8008 from Scelbi Computer Consulting, 1322 Rear, Boston Post Road, Milford CT 06460. Price is $19.95

James Electronics, P. O. Box 822, Belmont, Ca. 94002. For parts — fastest service I have experienced. Good prices on prime integrated circuits. Reputed to honor their guarantee instantly.

Poly Paks, P. O. Box 942E, Lynnfield, Ma 01940 — also good, but a little slower. Still faster than industrial parts houses!

The Computer Hobbyist, Box 295, Cary, NC 27511.

Hal Singer's **MICRO-8 User's Group Newsletter.** Excellent!!! Start here! Address: Cabrillo HS, 4350 Constellation, Lompoc, CA. 93436.

The Digital Group's stuff. Also excellent! Calculator chip interface, cassette interface, beautiful TVT, etc. P. O. Box 6528, Denver, CO 80206

Robert Cook for **CREED** (Baudot Code).TTYs. Excellent man. Unbelievably helpful. Give him your business. Write to him at Wilcox Enterprises, 25 W. 178 — 39th St. Naperville, IL 60540.

Edward DeGraaf
8516 — 47th St. No. 13
Lyons, IL 60534

Video Games

I've got an Altair 8800 and I would like to be on your subscription list. I have at the moment the basic Altair with 256 bytes and a KSR 33. I have on order Parellel I/O, TTY I/O, Cassette I/O, 12K dynamic RAM, Assembler, text editor, system monitor extended BASIC and like that.

With the above stuff and stuff hopefully to be developed by Dr. Suding and the Digital Group I plan to be able to do my own video games.

J. Scott Williams
P. O. Box 932
Bellingham, WA 98225

Hooked on Star Trek

I've got an Altair up and running. I should have a TV Typewriter hooked to it before long. Next I hope to get either MITS' BASIC or yours or somebody's. I noticed you were starting a series on a BASIC interpreter. Is that going to come off; I'm so hooked on Star Trek and other computer games I can't wait.

I really liked the article by Steve Dompier on "Music of A Sort". I had my Altair spewing forth Cat Stevens, Beatles and even a little Rolling Stones in no time. It liked "Daisy" best for some strange reason.

I'll keep you informed in how things are coming along and would be glad to hear from other people on how their projects are going.

From the land of Budweiser
(Anchor Steam costs too much down here)

Bob Beard
721 30th St.
Hermosa Beach, Ca. 90254

Computers for the Performing Arts

The person with the names and addresses of those interested in joining a 8800 Altair Users Group (San Diego) is:

Frank MacLachlan
Gamma Scientific, Inc.
3777 Ruffin Rd.
San Diego, Ca. 92123

As I told you, I'm getting into low-cost computers because I'm starting a nonprofit organization to promote the performing arts (classical music, theater) and our production system (IBM Exec., + headline machine) proved too slow to get out the kind of publication and other services we wish to offer. Instead of starting an empire of "slaves" and "gofers" to accomplish the work, I'd rather go into a higher level technology.

So we would go to keyboard and CRT display for input, with printer output (giving "hard" copy proof, handling correspondence and address labels) and another output to a phototypesetter (probably an old Photon).

Instead of paper tape, the Photon would get modified to read Philips cassette. Looks like mag tape machine might be Phi-Deck (completely electronic control, can search a 30-minute cassette in 20-25 secs, is dual track — from the Economy Corp., Box 25308, Oklahoma City, OK 73125).

I'd like to pursue multiple answers to some of our needs. Both TVT2 and the Suding CRT interface look promising. In the case of TCT2, I'd like to modify it to use the Motorola clc 128-character chip. As to the Suding, would want to figure out how to hook it to a DEC LSI-11.

As to computers, I want to see about getting quickly and easily (laugh here) into a 8008 of some sort, with Suding CRT interface. At same time, would like to take our Altair 8800 budget and put it into Digital Equipment Corp LSI-11 (completely compatible PDP-11, 16-bit machine with incredibly versatile instruction set, 4K of RAM, selling for $990 for one, $653 for 50-99, backed by DECUS users' organization with 175 programs, free membership and reasonable program acquisition cost.

Our computer would handle all word processing for the organization, as well as some for San Diego Symphony, Opera, Old Globe, etc. Also would maintain subscriber addresses. Eventually might handle accounts receivable. Word Processing problems follow:

LINE LENGTH — On phototypesetting input, would look up character width for each character typed, and would decide when to end each line. Would figure word spacing needed to justify right margin. Would be hyphenless justification until dictionary project is on-line, then would automatically look up word splits.

DICTIONARY — Would put about 35,000 word spelling dictionary, with word splits indicated, onto floppy disc. As writer completes words on keyboard, computer will look them up in dictionary and beep if unfind. That indicates either misspelling or unusual word. Freudian slips will be immune from this treatment, since the typo completes a word, although the wrong word.

ADDRESS MANAGEMENT — Probably on floppy disc. Since nearly all addresses are in San Diego and San Diego County, city, state and complete zip code can be coded with just a three-digit number (county zips a zero and two numbers, San Diego zips a one and two numbers). This should be a time saver for address maintenance (approximately 1/3 of time), as well as conserving storage. There are approximately 50 county zips (45 cities). File would be by zip. Alphabet readout not necessary if we keep a card file, so must decide whether to have electronic or card alphabet file.

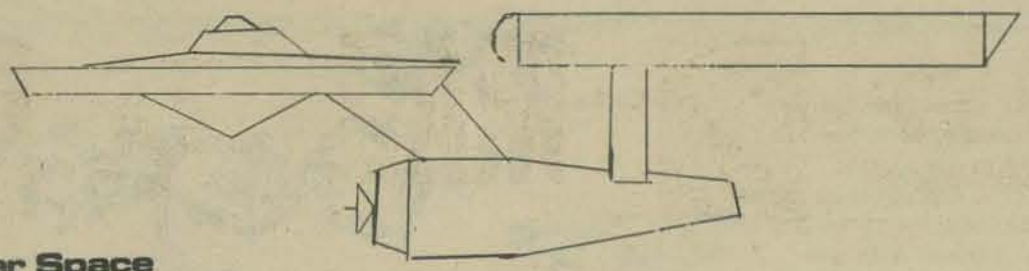
Another problem we want to pursue in parallel is that of keyboards. Want to try a number of low-cost keyboards to see if they can comfortably be used by someone working all day on them, as typist would. Have seen one keyboard only a hunt-and-peck specialist would tolerate. This would flunk our specifications.

How are we going to pay for this program. Have talked to a newspaper group and they are unfamiliar with all of this stuff. Am suggesting they pay for it all, and get report on our effort, have a lab with it all running available to them. In addition, they will have aided our nonprofit cultural project. I think this is the kind of stuff a newspaper could use quite effectively (for instance, 15 Suding CRT displays and keyboards interfacing with $1,000 DEC LSI-11 and floppy disc dictionary, the CRTs, tape units etc., average $600 per single unit, very cheap when compared to approximate — $4,000 per unit for current Selectric/OCR system).

I'm going to send copies this letter to area computer experimenters. Also some non-area.

Bill McLaughlin, Editor
Program Guide
Box 158
San Luis Rey, Ca. 92068

MAIL



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Hardware Stuff From Outer Space

I just received volumes 2 and 3 or your newspaper. Miscellaneous comments:

(1) What's all this about dragons??? (Dragons would stay away from computers. Their fiery breath would burn out the ICs.)

(2) Why does the "low cost home/school microprocessor system" use COSMAC? It is the most expensive microprocessor I know of.

(3) More suggestions for INCHWORM: Add a conditional branch capability, and perhaps a WAIT provision (stay somewhere for a while).

(4) I doubt if BASIC is the best language for small homemade systems where memory is limited. A Reverse Polish notation language similar to the system used on HP calculators would use less memory, be simpler to develop, and interpret faster. I hope to play around with such a language and maybe even implement it if and when I get around to building a microcomputer. (My interests are primarily theoretical – I don't usually actually do things, just figure out how.)

(5) The Do It Yourself PDP-8 or Microprocessors Strike Again! (Edward Epp & Sorosh Ahmed, take note.)
a. get rid of those TTL books, they won't be needed.
b. Write and ask Intersil, 10900 N. Tantau Ave., Cupertino, Ca. 95014, for information on their IM6100 microprocessor and support circuitry (6508 RAM, etc.). The IM6100 is a 12 bit microprocessor with the PDP-8 instruction set. It is a fairly expensive microprocessor but has the additional advantages of an on chip clock, and, being CMOS, operates over an extended temperature range, has fully static internal circuitry, doesn't need regulation of the single 5 to 10 volt power supply, and only uses .01 watt of power, as well as having excellent noise immunity.
c. Design the CPU, using CMOS support circuits (see later section).
d. Decide on the memory to be used. If you settle for 2102s, the whole system with 4K bytes of memory would cost between $500 and $700. If, however, you're willing to pay around $300 per kilobyte of memory, you could make an all CMOS system with several major advantages:

1. It would operate at 10 volts and would therefore be 40% faster.
2. It would run on batteries (rechargable) and could easily be built into a briefcase for a portable system ($40 would add a solar battery charger!).
3. Continuously applied power would make the memory nonvolatile.

e. Build it.

(6) All Star Trek programs I've seen (and some I haven't) are based on a space battle – but the show isn't. I've invented a Star Trek game (G20) that isn't battle based. It is played on a huge 3-D board and the primary objective is to explore planets. If anyone has several months of computer time and would like to try programming it let me know and I'll supply a more detailed explanation. Warning: It's complicated. Definitely not for BASIC.

(7) More Star Trek. My former high school had a HP9100B programmable calculator and I programmed it to draw the Enterprise and Klingon ships. I'm including a copy. The Klingon program is probably one of the most sophisticated programs ever written for the 9100B. After two revisions, every possible step saving technique and some impossible ones are used to cram the program in the 392 step capability of the machine. Anyone want the programs?

(8) The Warp Factor (no, this doesn't have anything to do with Star Trek) – my high school also had a timeshare terminal for an IBM 360. I discovered that outputting an integer *2 variable between 256 and 511 inhibited output and had all sorts of exotic effects. (In FORTRAN, of course.) This number, named the Warp Factor (also how tilted our pool table was!), came in handy quite a few times. Anyone with an IBM 360 terminal might want to experiment with it. I have no idea if it works on other systems.

(9) Back to hardware – most of this has been sent to the MICRO-8 Group

Use CMOS for all new circuits. The long predicted CMOS price drop has rendered all TTL based 8008 and nearly all TTL 8080 circuitry obsolete. See PDP-8 section for the advantages of CMOS.

Stay away from dynamic RAMs. They're designed for big systems and just aren't economical for small systems. For a 4K RAM try the Electronic Memories & Magnetic 4401 & 4402. They are lightning fast, static, and probably cost a fortune. If "charge pump" 4K RAMs are out they would be an alternative. (semistatic and even faster.)

Don't buy the Altair 8800. It's TTL and now vastly overpriced. Build your own and save 50%.

If even that is too expensive, keep a very close eye on MOS Technology's 6501. Altho it won't be available until late this year, the 100 quantity price is only $20! and it's NMOS with 8080 capabilities.

As soon as I find out something about the ICs, I hope to design improved 8008 and 8080 microcomputers. I'll keep you up to date on my efforts.

Incidentally, I'll be taking some minicomputer courses at Johns Hopkins University this fall. It should be interesting. Well, that's all for now.

Bobby Baum
6607 Pyle Rd.
Bethesda, MD 20034

Note on HP 9100B plots – I'm nearly out of Enterprises so I couldn't send a full sheet of paper. Arithmegig is the mathematical division of GIPPGIG Consolidated Enterprises, my one man company that does nearly everything.

I/O Bus - Altair

I've done something that might be of interest to you and your readers. I've designed and built a parallel I/O BUS for my Altair. Back in March, my $397 Altair with 256 words of memory was running – with no hope of getting any more goodies from MITS for a good long while – I decided to design my own I/O interface with as little impact as possible on the basic 8080 I/O configuration.

I liked the RGS Electronics I/O BUS philosophy – 256 I/O devices multi-dropped on a single I/O BUS and providing input, output, and control to each device – so that's what I did.

My circuit uses four Altair I/O port addresses to provide the parallel I/O capability. Actually I've only taken three ports as my CONTROL strobe coresides on prot 255 with the Altair sense switches. The RGS Electronics parallel I/O board (or kit) can be used to interface an I/O device to the parrallel I/O BUS. Therefore, any RGS Electronics I/O device can be run on the Altair – or your own device or you can construct your own I/O device interface. Anyway . . . it really works great.

The parallel I/O interface board recognizes addresses 252, 253, 254 and 255, and according to the actual address decoded – plus the command tself (I/P or O/P) provides a strobe signal (select device, input, output, or control out) down the I/O BUS. Data from the 8080 AC accompanies the strobe to the previously selected device interface. If the strobe is a select, all I/O device interfaces on the BUS take the data as a device address. If an address match occurs, that device is then the selected device and will remain selected. Selecting a non-existant device will de-select all devices on the I/O BUS.

I built my original parallel I/O BUS interface on a breadboard (it's still there!), but as soon as time permits, I'm going to build it on an Altair 88 PPCB. Hopefully, by the time you get this note, it'll be on the 88PPCB. Of course – it can also be built on a SSM General Purpose board.

I'm putting together a full set of documentation I have some friends who want to build it – and when I have it completed (hopefully within a week) I'll send you a copy.

Jim Brick
820 Sweetbay Drive
Sunnyvale, Ca. 94086

Music & Games & I Ching

I just finished reading Vol. 3 Nos 1-4, and I am really excited. As soon as school starts again, I'll be writing some programs of course. A few of the things that I'm going to be doing –

I CHING a complete printout, hexagram, decision, commentary, everything. Using initialization of RND to generate each line.

MUSIC PROGRAMS something to compose it (software) and print a staff something to play it directly from the TTY without completely rewiring the TTY (because its the schools TTY).

SOMETHING to generate words, which is the reason this is on graph paper, I used my last piece of regular paper to write Byron Caloz (PCC, Mar, '75 page 10) about his SUMWRD. What I have is a formula for monosyllabic possible English words. See your local copy of "Essays on Language and Usage" for more, it's one of the essays. I have a rough program (it only works half the time) and I do get some words off it.

Another thing that I am thinking about is using a mini to control some aspects of a synthesizer, such as maybe envelope or hows about sticking a mini-composer in there and then jam along with it! As soon as I get some dough together I am building a synth, so I'd appreciate any info you guys have on all aspects of synths, hard and soft wise.

Another thing that I want to do is to program some really complex simulations, the socio-econom-politico polemic kind, which is every kind. My school has two TTY's, so what I'd like to do is to inter-connect them and get the computer to act as an umpire and bookkeeper using LSI (that's limited strategic intelligence). Maybe you could play against the computer in a game such as USN or Diplomacy – any thoughts on that? Along this line, do you have a run of STAR TRADER in any issue? If not, I'd really like to see it.

Maybe you'd like someone to write an article on this. If you don't mind, I'd like to help. Also, if you know of anyone with similar interests, I'd appreciate it if you connected us.

Tony Audas
5530 Pebbleshire Rd.
Birmingham, MI 48010

THE ENERGY PRIMER
Portola Institute 200 pages

If all of the recent books and articles on non-depletable energy resources spawned by the "Energy Crisis" were to be judged on the basis of the contribution they can make to the average reader's energy picture, most would serve their highest as barbecue lighters. After showing you how to harness the tides of the Bay of Fundy for only $60,000,000 or heat your house with solar energy for $14,000 or pave the Southwestern desert with solar cells, most authors have shot their wad.

Not so with the Portola Institute's (The Whole Earth people) "Energy Primer". While the Primer does not totally ignore the more grandiose schemes that are the stuff that Sunday supplements are made of, by far the larger part of the book is made up of information usable to the individual or small community.

The section on wind power presents an almost total picture of the state of the art, of generating electricity, pumping water or running a mill with wind. The sources, prices and application information are enough to permit an economic analysis just from the information contained in the book. Just as in the sections on solar, water and biofuel, you are first given an overview of the theoretical factors involved. This is both comprehensive enough to be understandable to any layman possessed of the practical skills needed to start out on a program of energy independence. Next comes a listing of additional reference sources, and comprehensive data on most of the wind machines available on the market today.

The configuration of the other sections follows the same pattern of introduction, explanation, references and sources. One of the characteristics that I as an Engineer appreciate is the fact that none of the authors make it sound easy. There is none of this "$200 makes you free of PG & E (or Con Ed) forever." The difference between being tied to the infinite capacity of a utility and having to match your demands to your own resources is clearly brought out. In fact, some of the energy discipline this book suggests would be a good idea for us all to practice even when we do have utility connections.

If any section of the book could be said to be my favorite, it would be the section on Architecture. Here, one of the most important lessons, how to configure your residence to require less total energy input, is given thorough treatment. Even the apartment dweller can find valuable advice to cut down energy use without degredation of comfort. If the principles expounded here were to become general practice, the Arabs would be out of their Cadillacs and back on camels in no time. Closer to home, more of the paycheck would be left for the finer things in life.

This is one of the few books about which it can be said, there is something in it for everyone.

– O.S.

(The Old Soldier)

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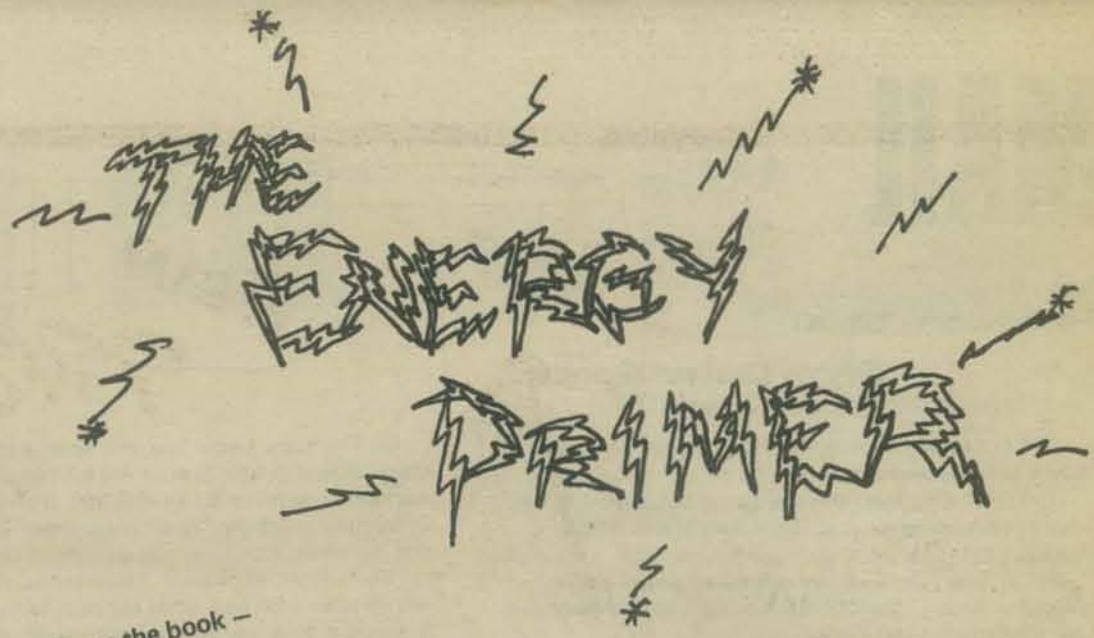


From the book –

More and more the energy resources of the world are coming under the control of international corporations and energy cartels. Growing scarcities of energy and natural resources will continue to determine major political policies in the future. To balance this trend, we need to diversify and disperse the physical energy base and dilute the growing economic power bases . . . a trend that will help us all. *The most obvious way to do this is to develop and adopt scaled-down renewable energy systems that are utilized where they are needed and designed for local environments and requirements.* The new politics of self-sufficiency . . . relying on ourselves and our own decentralized energy resources . . . will conflict with the present politics of centralized institutions and industry. Hopefully, in time, it will come to supplement this tradition rather than conflict with it. The important thing is that we generate as many options as we can for a future whose course grows more uncertain every day.

> *"It's easier and cheaper to* save *the energy we get from conventional sources than it is to* earn *(generate) energy from newer, more expensive sources such as the wind and sun. For example, it's cheaper and easier to insulate a home than to produce energy (from renewable sources) to heat an uninsulated dwelling. . . If we consume all of our fossil fuels in our cars and 'space-hippy' vans, we'll never see the solar-based society to which we must move if we want to survive."*
>
> —Lee Johnson and Ken Smith

We should have no illusions about local energy systems. Our exaggerated needs *cannot* be supplied by solar, wind, water and biofuel energy alone. The prerequisite to using any renewable energy system is CONSERVATION. Without conservation, techniques and devices for using renewable energy will always seem impractical and will always make little economic sense.

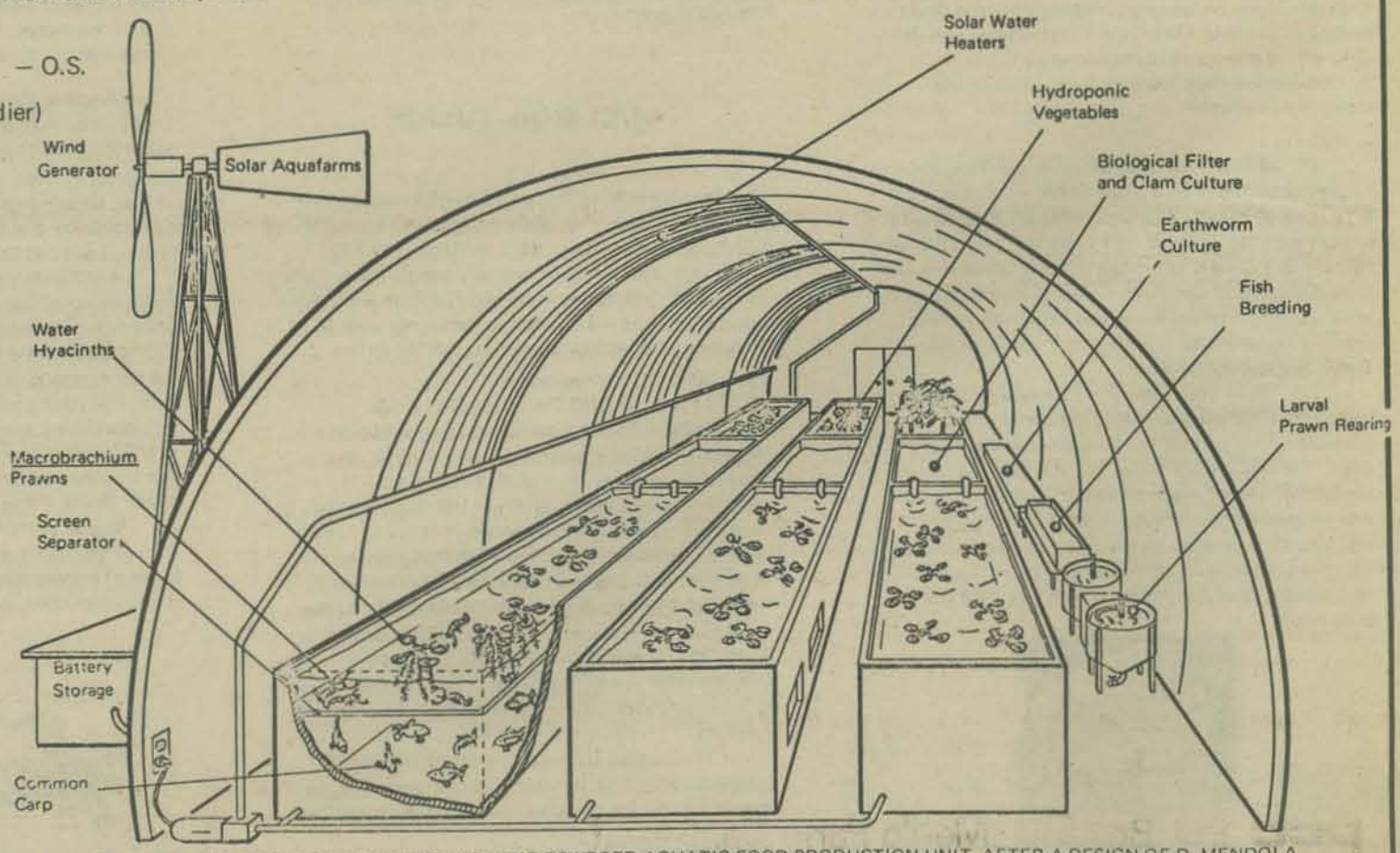
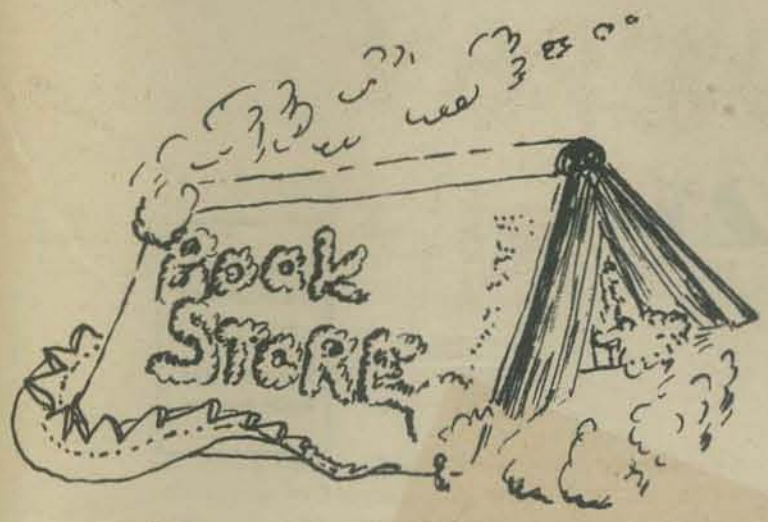


FIG. 12 A 100' x 30' "AQUASOLARIUM" SOLAR-WIND POWERED AQUATIC FOOD PRODUCTION UNIT. AFTER A DESIGN OF D. MENDOLA, NEW ALCHEMY INSTITUTE–WEST AND S.A. SERFLING, SOLAR AQUAFARMS, DAVIS, CA.



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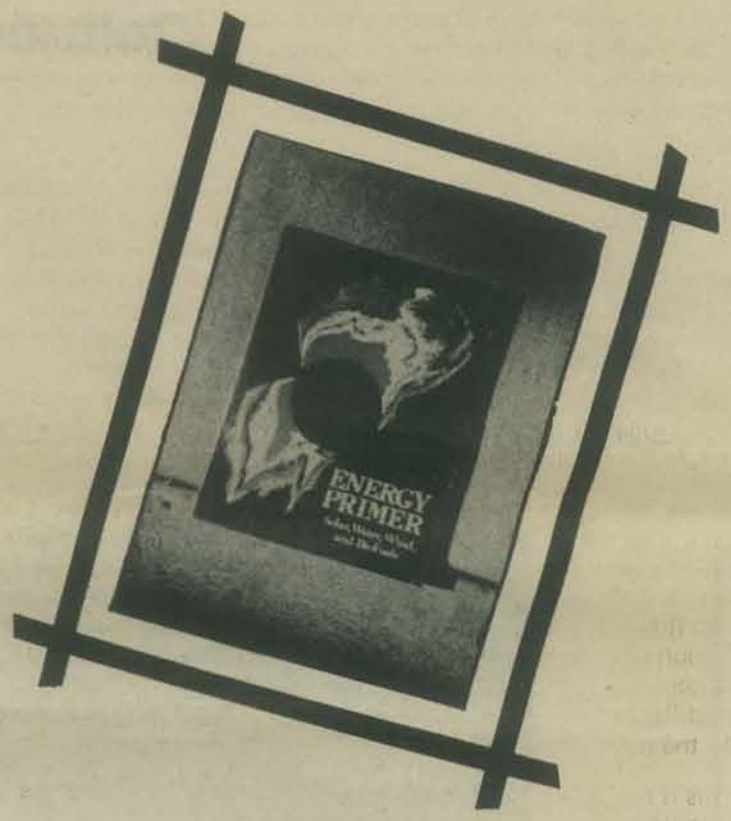

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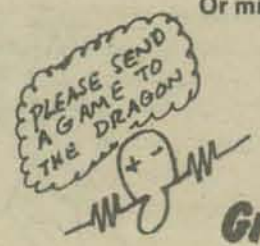

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