

New Mexico Greets Altair Owners

MITS, Inc. is pleased to welcome all ALTAIR owners and their guests to Albuquerque, New Mexico, for the WORLD ALTAIR COMPUTER CONVENTION. Your participation and enthusiasm are certain to make this event a landmark in the home computing field. Many activities, seminars, demonstrations, and displays have been scheduled in order to provide an educational, enjoyable weekend for everyone who attends.

If you are an ALTAIR owner who was unable to attend the WACC, we hope

of the ALTAIR 8800 Theory of Operation and a reference packet to ALTAIR BASIC, will be given away to all who attend the seminar.

You may register for the convention in the lobby of the Airport Marina between 8:30 and 12:30 Saturday morning. Registration entitles you to attend all lectures and seminars. There is no fee. Bus tours of the MITS plant will be conducted all morning, beginning at 8:30. The half-hour tours will allow you to see MITS production areas. The

MITS, will deliver a brief welcoming speech. David Bunnell, Barbara Sims, Gale Schonfeld will be there to conduct the meeting and to answer your questions. This is your chance to let us know what your problems and/or suggestions about MITS products are. Everyone is urged to attend, as there will be election of officers and open discussion on how you, the ALTAIR users, would like to organize and maintain the club and its services.

WELCOME to the WACC

that this issue will help to bring the events and excitement of our first computer convention to you. Also, be sure to see next month's issue for complete convention coverage.

The scheduled events of the WACC begin at 8:00 Friday evening, with a presentation of MITS Traveling Seminar. Pat Ward, director of Public Relations at MITS, will be your host and lecturer. The short course is designed for beginning home brewers and all of you who would like to brush up on the "basics". Pat intends to introduce basic hardware and software concepts, including the computer structure of the ALTAIR, the operation of the 8800, and instruction in basic machine language. Free ALTAIR Technical Binders, which contain a short history of computers, a part

tours will end in MITS main lobby where Pat Ward will be on hand to demonstrate our products.

The Bernalillo, the Brazos, and the Pecos Rooms of the Airport Marina will be open all day Saturday and until 12:30 Sunday. The thirteen demo finalists of the ALTAIR demonstration contest will be up and running in the Brazos and Pecos Rooms. Rich Wilder of Palo Alto, California, will be there to provide you with music from his homebrew synthesizer, and you may even try your hand at backgammon, thanks to Steve Grumette of Los Angeles or Randy Miller's chess program (Tempe, Arizona). The demos are your contribution to the WACC. We think that you'll find this opportunity to see other kit builders' work especially rewarding.

Saturday afternoon's program begins at 1:00 in the Marina Ballroom. Two advanced concept meetings will be conducted simultaneously. MITS software personnel and MITS hardware engineers

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ANNOUNCING:

altair 8800 b!

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680 Software - - - page 9

ALTAIR dealers from a number of cities across the U. S. will be on hand in the Bernalillo Room to display product literature from their respective stores. If you've never had the chance to drop by the "ALTAIR Outlet" in your vicinity, here's a good opportunity to come in and get acquainted. You may see ALTAIR hardware products on display, and a representative from our company will be there to answer any questions you may have about our computer equipment.

The first official meeting of the ALTAIR Users Group is scheduled for 10:00 Saturday morning in the hotel ballroom. Ed Roberts, president of



Across the Editor's Desk

by David Bunnell

One Last Time

This is the last time for Across the Editor's Desk, as I have decided to promote myself to publisher and turn over the editorial reins to Andrea Lewis. (Incompetency rises to the top)

Actually, Andrea has been my "secret weapon" in the production of Computer Notes and she has done the majority of the editing work in the past issues. Andrea is well versed in the technical writing, editing field and she has been with MITS since the beginning of the ALTAIR movement.

Therefore, C. N. is in good hands.

Computers are not Tupperware

The previous reference to the ALTAIR "movement" was no accident. While many people in the marketing business seem to think that format, style, price, etc., are the essential ingredients of a successful product, and while the prevailing attitude is that "Americans will buy anything as long as it is packaged right"--there are vast distinctions between products and their implications.

In recent years, technology has gotten a black eye. Our automobiles pollute the environment, our food processing causes cancer, our nuclear power plants appear to be unsafe, etc. Yet, it is clear that technology will play an increasingly important role. Technology, when it is properly applied, and when those who apply it respect the dignity of human life, can answer many of our problems. It can disprove the prophets of doom.

And on the other side of the coin, the back to nature movement, while it marks an important change in attitude about our relationship with our environment, it doesn't provide solutions for the masses of humanity. Urban life is a reality that must be dealt with. Everyone can't live on a farm.



"Good, I'll take all of them."

The point of all this is that the ALTAIR Computer is not just another product. Its implications--the actual changes it may cause in our society--are significant.

With that in mind, the people involved in the ALTAIR "movement" have a common responsibility. These people include MITS, other manufacturers, ALTAIR owners, magazine editors--the whole scope of people, clubs, and businesses that are a result of the ALTAIR.

It is somewhat beyond me to define this responsibility, and it certainly shouldn't be dictated by the manufacturers. However, it is not be-

yond me to point this out with the hope that it will be considered and talked about.

Have you ever rented a hotel?

There are moments in everyone's life that seem to take on importance simply because they are remembered. One of these moments for me was the day I called up the Marina Hotel to tell them about the World ALTAIR Computer Convention. The segment of the conversation that I remember most went like this:

Marina Hotel: "Oh, that's lovely, how many rooms will you need?"

Me: "How many have you got?"

Marina Hotel: "220."

Me: "Good, I'll take all of them."

Actually, the people at the Marina Hotel, particularly Pauline Van Nostrand, have been most cooperative and we wouldn't have been able to do it without them. And we appreciate it.

Thanks to Everyone

Putting together a convention is a multi-faceted operation involving thousands of details. MITS is fortunate in having a staff of very conscientious employees. People who take responsibility and know how to think on their feet.

We are also fortunate to have so many enthusiastic customers. The number of people paying their own expenses to come to the WACC is staggering.

I'd like to thank everyone who has helped with this convention... It's fantastic.

You Haven't Heard the Last of Me

While I won't be writing a column called Across the Editor's Desk, I will continue to make contributions to Computer Notes in one form or another. Someone has suggested that I write a column called, Across the Publisher's Desk, but I declined. It reminds me too much of the days when I was a sports editor and wrote a column called, you guessed it, On the Bench.

Computer Clubs

Anyone interested in forming a computer group in the following areas should contact the person listed below:

Randel Sather
Radec, Inc.
Suite 810
5575 Poplar
Memphis, TN 38117
(901) 761-0281

Gordon Staley
3412 N. E. 151st St.
Portland, OR 97230

Guy T. Hall
183 East 8th Ave.
Chico, CA 95926
(916) 345-9396 (office)
(916) 345-8436 (home)

BAMUG
Richard Lindberg
3327 Victor Ave.
Oakland, CA 94602
(415) 530-0778

Mr. Jon Elson
1606 East Swan
Brentwood, MS 38144
(314) 962-6103

Emile Alline
1119 Pennsylvania Ave.
Slidell, LA 70458
(504) 641-2360

Richard Schaal
Rt. 12, Box P32
Ft. Myers, FL 33901



USERS GROUP NEWS

By Barbara Sims

SOFTWARE LIBRARY

There have been requests for Software Library programs written in BASIC language. If you have sent in entries in the past, or would like to send in entries to our Software Library, please do so. We accept many programs and subroutines each month. Rules on the cover of our Software Library Update should be followed. Your entries must be typed on our coding form. Programs that are sent in in some other form will possibly be turned down because of the time consumed having to re-type programs. Xerox copies are not acceptable. \$16.00 worth of coupons, for programs in our Software Library, are given out for each accepted program. Credit prizes toward the purchase of MITS equipment is given out to winners of our monthly Software contest. Please send all entries to the attention of our Software Department.

In the January issue of Computer Notes, we accidentally overlooked putting in a description of Software Program #1229752 by Matthew Smith. This program was accepted into the Software Library, and is described on page 9 of your Software Library Update.

WORLD ALTAIR COMPUTER CONVENTION

Plans for the WACC are coming along nicely. We do expect a large crowd at the convention, so please get to the scheduled seminars in plenty of time for a seat. Hopefully we will get a chance to meet each of you sometime during the weekend.

WACC

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will be the featured speakers at the respective sessions. The talks are scheduled as follows:

SOFTWARE PROGRAM 1:00 and 3:10

Bill Gates - General Software Presentation (40 minutes)

Mark Chamberlin - "680 Software Presentation" (20 minutes)

Paul Wasmund - "Package II Presentation" (20 minutes)

Questions and Answers (30 minutes)

HARDWARE PROGRAM

1:00 - Tom Durston
"Mass Storage Devices for the Altair"

2:05 - Pat Godding
"Interfacing the Altair to Peripheral Devices"

3:10 - Steve Pollini
"Designing a Computer System Based on the Motorola/AMI 6800 Microprocessing Unit"

4:05 - Bill Yates
"Design Theory of the Altair 8800B"

A seminar of talks covering many different phases of low-cost computing will begin at 7:00 Saturday evening and will feature a number of prominent speakers from the computer hobby world. MITS has invited Larry Steckler, technical editor of *Radio Electronics*, Carl Helmers, editor of *Byte*, Art Childs, editor of *Interface*, David Ahl, publisher of *Creative Computing*, Ward Spaniol, president of the Southern California Computer Society, Terry Silver, also of the SCCS, and Ted Nelson, author of *Computer Lib*, to be panel members for this seminar. Each panelist

will present a brief talk on some aspect of home computing. After the presentations, the floor will be open for general discussion. This promises to be quite a lively session, and it should be difficult NOT to participate. So come prepared with your questions and comments.

All demonstrations and booths in the Bernalillo, Brazos, and Pecos Rooms will be open Sunday morning. The thirteen finalists in the demo contest will be judged at this time. The judges will be experts in the computer field, who are not employed by MITS, Inc.

The ALTAIR Awards Banquet highlights Sunday's events. It begins in the Ballroom at 1:00. Tickets are \$10.00 and will be sold at the door. The banquet ticket entitles you to dinner, and also offers you the chance to win one of the many door prizes. MITS products, including Vector Interrupt and Real Time Clock cards, various SIO boards, PIO boards, and ALTAIR 680 gift certificates are among the prizes to be given away. David Bunnell, vice-president of Marketing at MITS, will host the presentation of awards. The Software Contest prizes are a \$1,000.00 gift certificate to be given to the best major program writer and a \$250.00 gift certificate to the best subroutine writer.

Grand Prize in the Demonstration Contest will be an assembled Altair Floppy Disk Drive and Controller. Second prize will be an assembled Altair 8800B with 4K static memory, and third prize is an assembled Altair 16K Static Memory Card.

We plan to conclude the WACC with an introduction to Albuquerque's historic Old Town. Two buses will leave the Marina Hotel for Old Town immediately following the Awards Banquet. The tour is free and will be conducted by the Albuquerque Chamber of Commerce.

Altair Finds Home With Home Finders

On March 1, 1976, the DAYLIGHT SAVINGS CO's computer operating system, using an INTEL 8080A packaged by ALTAIR made its debut at MARIN HOMEFINDERS and operated throughout the day performing regular business functions of record storage and retrieval by regular company employees without a single instance of loss of full control of the computer by the operator.

Operating on 4K, the system provides for 36 records at a time in core (approximately two days new listings) and permits instant deletion of records identified by cursor control. Routines for programming and printout of memory in octal notation, plus keyboard switching from CRT to TTY hardcopy are available interchangeably with data handling facilities.

The system is in regular business use from 9 am to 7 pm weekdays and 10 am to 4 pm Saturdays and Sundays, and is available for demonstration outside these hours by appointment.

Daylight Savings Co.
1917A Bridgeway
Sausalito, CA 94965

Watch for the Marin Homefinders people at the WACC. They'll be running in the Demonstration Contest with a very useful demo that will record information on all WACCees and distribute it free. If you'd like to buy or sell equipment or just communicate with other Altair owners who share your interests, stop by and let them record your name, phone or room number and a brief message or "want ad."

Norm Tilbury of Homefinders says he has his eye on the Grand Prize of an Altair Floppy Disk to expand the Daylight Savings Co. system described above. We're sure Norm's not trying to influence the judges, but here is one of the many good things he has to say about the Altair:

"The Altair, the Intel 8080, is so incredibly smooth it boggles, absolutely boggles. We put this operation out in place of timesharing on the Nova, and it's operated absolutely flawlessly ever since, for weeks now; never a hardware or software failure. Absolutely as smooth as glass. It doesn't have a large repertory of capabilities yet, but it's demonstrated the capacity to quite readily perform anything we can dream up..."

Thanks, Norm, and Good Luck in the competition!

Ramblings from Ed Roberts

NEW PRODUCTS

8800B: The 8800B will be formally introduced at the WACC. Production shipments on the 8800B will start during April and we expect full production to be accomplished by May. In a previous issue of Computer Notes I talked about some of the features of the 8800B. Complete details as well as demonstrations of operational units will be available at the WACC.

8800A: The original model 8800 is going to be discontinued and replaced by the 8800A which includes a number of improvements and options over the original machine. The 8800A comes with a power supply rated at approximately 10 amps, includes an 18 slot motherboard and a fan as part of the basic price. Production on the 8800A will begin in April. Of course it can be updated to a B at a later date.

16K Static: The 16K static card will also be introduced at the WACC. The 16K card uses memory which has an access of 215 nanoseconds and the total power consumption of these cards is less than a 4K dynamic board. It will no doubt become the standard memory in large systems.

High Speed Paper Tape Reader: The high speed paper tape reader also will be formally introduced at the WACC and a number of other new products that haven't been announced formally.

DEALERS

We have done a good bit of experimentation and pioneering in the past year in terms of developing the low cost computer market. One of the experiments that has proved to be very successful has been our dealer program. As I have mentioned in previous columns, and as most of our readers are aware, the number one problem most users experience is receiving support and getting their system operational. Many of these problems are simply questions that can be answered by a qualified dealer. Some are more complex problems and actually require some technical assistance. Our dealers provide this capability at the user level. In addition to this they provide off-the-shelf delivery of

materials and equipment. Therefore, our major marketing thrust throughout the remainder of the year will be to increase the size and effectiveness of our dealer network. It is our intent to make sure that all of our dealers are enthusiastic home computer types that have a well founded technical background so that they can support the end user. Please let me know of any idea, suggestion, or criticism of our current dealer network.

680

The 680 program is still pressing ahead, but the hardware phase is behind schedule. The software phase is well ahead of schedule. We now have a full up 8K BASIC operational in the 680 which is essentially identical to the 8K Altair 8800 BASIC. I consider this development of the 680 as a major breakthrough for the small system user, and I am sure it will increase the popularity of the 680 enormously. Hopefully, by the time the next Computer Notes is published I will be able to report that high volume 680 production is under way. Development of the 8K memory card for the 680 is also ahead of schedule and will probably be formally announced during April. A number of other peripherals are also in various stages of development for use with the Altair 680 and will help to make it the first full 680 based computer system available (i.e., computer system that is fully supported by both hardware and software).

Related to this, there also has been some discussion that implies that the Altair 680 is not compatible with all software developed by Motorola. This is not true - the 680 will run all Motorola software with little or no modification. It also will run all the 8K Altair 8800 BASIC programs.

FLACK

I still receive a number of letters each month regarding various subjects. The number one problem currently is still delivery, but that problem is certainly at its lowest ebb in a year and a half. The number two problem is cycle time through the repair department, which while not instantaneous, by the end of the month will be typically less than a week turn around on the majority of MITS products. By turn-around time, I am referring to time spent in-house.

PHONE RESPONSIVENESS

There are two problems that are occurring in regard to phone responsiveness. One is that some of our customers are calling repeatedly and speaking to different people each time. May I suggest that you stay with one person so that you don't have to reiterate past history, etc. The second problem inherent in this is the high cost of phone calls, which we hope to eliminate by our dealer operations being available to provide local support.

WACC

The first World Altair Computer Convention will either be in progress or just completed by the time you receive this. Like many other initial efforts, we have had no data to draw on as to what should occur at the WACC. We have tried to meet several requirements. First, of course, is to make it interesting. Second is to make it educational, and third and probably most important, is to provide an interface between the people that use our products and MITS and between users from all across the country. Hopefully, a large amount of data will be transmitted in both directions that will be useful to Altair users as well as to those of us at MITS.


 The logo for MITS (Micro Instrumentation and Telemetry Systems) is displayed in a large, bold, stylized font. The letters are interconnected and have a thick, blocky appearance.

2450 Alamo SE Albuquerque, NM 87106

The people who design and manufacture Altair Computer Products.

PRELIMINARY RELEASE**altair 8800-b**

by Bill Yates

The 8800-B is an improved version of the original ALTAIR 8800. It incorporates several entirely new features, and some improvements directed at fixing problems with the original unit that have become apparent over the past year.

Briefly, these changes include:

- a) Redesigned front panel
- b) Heavy duty power supply
- c) New CPU board
- d) Single piece 18-slot mother board

The "B" does require the new CPU board to operate, but all other existing 8800 plug in cards are compatible with the "B". The case is the same as the original 8800 (Optima) case.

FRONT PANEL

The "B" front panel retains the same switch and LED arrangement as the original 8800. However, the metal dress panel has been replaced by a Duralith (laminated plastic and mylar, bonded to aluminum) dress panel that has multi-color, functionally designed graphics. The LED indicators are now back-lit through the panel and the panel is "dead-front", that is the LED's cannot be seen unless they are on. The toggle switches have 50% longer handles that are flatted (instead of round) for easier use.

The front panel Display/Control board connects to the 8800 bus through a Front Panel Interface board (standard size ALTAIR plug-in board). The Display/Control board and Front Panel Interface board are connected by two 34-conductor ribbon cable assemblies. These are terminated with card edge connectors at the Display/Control board. The wiring harness between the Display/Control board and the bus has been completely eliminated.

Electronically, the Front Panel Interface Board buffers all lines to and from the 8800 bus. The bus lines no longer drive anything on the Display/Control Board directly.

The following front panel functions have been added to those on the original ALTAIR.

- a) SLOW: When held depressed, this switch causes the machine to execute instructions at the rate of about 5 machine cycles per second. (Normal machine speed is about 500,000 machine cycles per second.) This is useful in debugging programs, where it would be too time consuming to single step through the code.
- b) DISPLAY ACCUMULATOR: Displays contents of the CPU's A register in the data LEDs.
- c) LOAD ACCUMULATOR: Loads the CPU's A register with the contents of the lower 8 "address" switches.(A0-A7)
- d) INPUT ACCUMULATOR: Inputs to the A register from the I/O channel that is selected by the upper 8 "address" switches (A8-A15). (Except for channel 255, octal 377, which is the dedicated front panel I/O channel.)
- e. OUTPUT ACCUMULATOR: Outputs the contents of the A register to the I/O channel selected by the upper 8 "address" switches (A8-A15). (Except for channel 255.)

I/O channel 255 (octal 377) and effectively channel 254) are dedicated, as with the original 8800, to the front panel. An input from channel 255 will input the contents of the upper eight "address" switches (A8-A15) to the A register. The "B", however, also allows outputs to channel 255 in the RUN mode. The output data is latched and displayed in the data LEDs.

The "B" has a single-piece, 18-slot mother board that eliminates the need for expander board wiring.

Electronically the Display/Control board has been completely redesigned. The logic design is now totally synchronous. The approach used is to allow the D/C board to access the CPU's input data bus when the machine is stopped. Once this is done, the D/C board can jam instructions onto the bus and force the processor to execute them by controlling the READY line. The front panel functions are generated by having the D/C board jam the appropriate sequence of instructions to perform the required function. These sequences actually consist of alternate "D/C" instructions and "CPU" instructions. The "D/C" instructions configure the D/C board so that the next byte (the "CPU" instruction) is correctly presented to the processor from the appropriate source. The "CPU" instructions are standard 8080 machine code. These sequences are stored in PROM (1702A). The PROM has been divided so that each sequence has been allocated 16 bytes, which allows each sequence to consist of up to 7 bytes of 8080 machine code (the last byte has to be a stop code). This allows the user some flexibility in redefining the front panel switch functions for his own custom applications if he so desires.

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**HARDWARE**

Altair Floppy Disk System

The ALTAIR Floppy Disk System offers the advantage of nonvolatile memory, plus relatively fast access to data. The Disk Drive unit (shown below) consists of a PERTEC FD400 mounted in an Optima case. (The case is 5 1/2" high, same depth and width as the computer.) The Disk Drive unit includes a power supply PC board and a Buffer/Address/Line Driver PC Board. A cooling fan maintains low ambient temperature for continuous operation. The Disk Drive cabinet has two 37-pin connectors on the back panel. One is the input from the Disk Controller, and the other is the output to additional disk drives. Up to 16 drives may be attached to one controller.

The Disk Controller consists of two PC boards (over 60 ICs) that fit in the ALTAIR chassis. They interconnect to each other with 20 wires and connect to the disk through a 37-pin connector mounted on the back of the ALTAIR. Data is transferred to and from the disk serially at 250K bits/second. The Disk Controller converts the serial data to and from 8-bit parallel words (one word every 32 usec). The ALTAIR CPU transfers the data, word by word to and from memory, depending on whether the disk is reading or writing. The Disk Controller also controls all mechanical functions of the disk as well as presenting disk status to the computer. All timing functions are done by hardware to free the computer for other tasks. Power consumption is approximately 1.1 amperes from the +8v (VCC) line for the two boards.



ALTAIR FLOPPY DISK DRIVE UNIT

The ALTAIR Disk Format allows storage of over 300,000 bytes. Since the floppy "diskette" is hard sectorized (32 sectors for each track), we write 137 bytes on each sector, 9 of which are used internally (track #, checksum) leaving 128 data bytes

per sector, 4096 per track. A hardware interrupt system can be enabled to notify the CPU at the beginning of each sector. One floppy diskette is supplied with each drive; extra floppies are available for purchase. The diskette and the disk format are not IBM compatible.

A preliminary version of Disk Extended BASIC has already been shipped, and the production version will be ready to ship on March 29, 1976. Disk Extended BASIC provides the user with complete facility for reading or writing data files and saving and loading program files. All file names are eight character ASCII strings. Three file access modes are allowed: ASCII sequential input ("I" mode), ASCII sequential output ("O" mode), and random mode ("R"). In random mode, the user can read or write the nth 128 byte binary record in the file. Listed below are some of the features of ALTAIR Disk Extended BASIC:

FEATURES

NOTE: Parameters enclosed in brackets [] are optional.

- MOUNT** {disk number}, [{disk number}]
no argument means all disks
Mounts and initializes for I/O the floppy disk on drive {disk number}.
- UNLOAD** {disk number}, [{disk number}]
no arguments mean all disks
Closes all files on {disk number} and disables all I/O on that disk.
- KILL** {file name}, {disk number}
Deletes the file on the disk specified.
- OPEN** {mode}, [#] {file number}, {file name}, {disk number}
Opens the file in the mode given on the disk specified. The file is assigned a file number (1-15) for further I/O operations.
- Mode is a string formula whose first character must be
O = sequential output
I = sequential input
R = random
- CLOSE** {file number}, [{file number}]
no argument means all files
Closes the file(s) given.
- INPUT** # {file number},
{variable list}
Reads the information on the sequential input file {file number} into the variable list specified.
- PRINT** # {file number}, [USING {string formula};]
{formula list}
Writes the ASCII representation of the internal format on the formulas given on the file {file number}. (Example: PRINT #1, 3) puts a space, 3, space, carriage return on the output file.

New Products More Memory

Does your Altair need room to think? Consider MITS' newest memory card, the 16K Static RAM Board. The 88-16MCS provides up to 16,384 8-bit words of random access memory on one card. Four 88-16MCSs provide you with the entire 64K of memory directly accessible by the Altair.

The 88-16MCS also offers you two surprise features--minimal power requirements and fast access time. Only +5 volts (400 milliamps, max.) and +12 volts (200 milliamps, max.) are necessary to operate the 88-16MCS, and there are no wait states, thereby assuring you of speedy access time.

Full production of the 88-16MCS begins April 16, 1976. You may purchase our newest memory card in kit form at \$765.00 or assembled at \$945.00.

Access Time	215 nanoseconds, max.
Capacity	16,384 x 8 bits
Power: +5volts	400 milliamps, max.
+12volts	200 milliamps, max.
Altair Slots	one

New Products

Teletype Call-Control Kit

The MITS Teletype Call-Control Kit provides a much lower cost and faster way to get a Teletype into your system than was previously possible. MITS has made an agreement with Teletype whereby the fully assembled mechanical portion of the Teletype will be shipped directly to you from Teletype Corp. and the PC board Call-Control Kit will be shipped from MITS. Starting in May, delivery time should be a couple of weeks as opposed to 4 to 5 months.

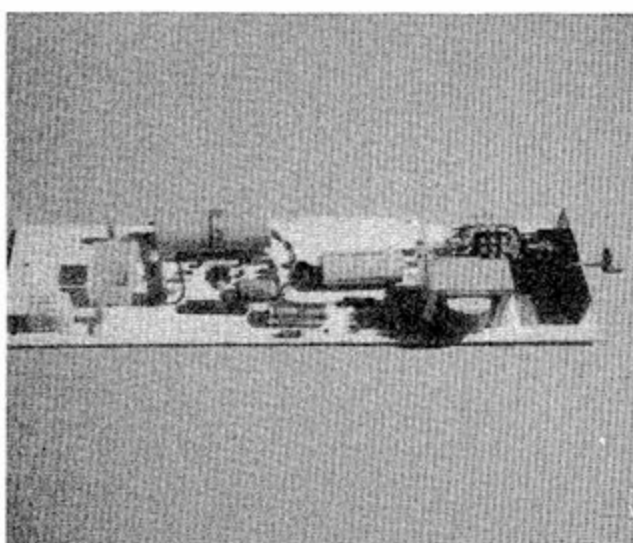
There are three Call-Control Kits available: 88-TYR which is supplied with the Teletype Printer only, 88-TYK which is supplied with Teletype Model KSR-33 (printer and keyboard), and 88-TYA which is supplied with Teletype Model ASR-33 (printer, keyboard, paper tape punch and reader). All three kits use the same basic printed circuit board (see parts layout, this page). All you need to do is assemble as much of the PC board as applies to the model of Teletype you have purchased, mount it to the Teletype chassis, and plug it in.

The PC board for the 88-TYR (printer) kit has a power switch, two fuses, a simple power supply and the receive circuit for 20ma current loop. Interconnect plugs and mounting hardware are also provided.

For the 88-TYK kit, a relay for line-local switching, a connector to the keyboard, and some transient damping circuitry are added.

For the 88-TYA kit, all of the above is included with the addition of another simple power supply, connections for the paper tape reader, and a circuit to control the reader by program control.

That's all there is to it. The Most complicated part of the assembly is connecting wires from the line-local relay to the PC board. The 88-TYA kit should take only 3 to 5 hours to complete. At \$500.00 savings, that's \$100.00 an hour for your time.



CALL-CONTROL PC Board



altair users

Wesley Tanoue
2147 Kaumana Dr.
Hilo, HI 96720

Carl C. Andreasen
Fisher Control Co
R. A. Engel Tech. Center
Marshalltown, IA 50158
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Marietta, GA 30061

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Kailua, HI 96734

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Hunting Heights Dr.
Storrs, CT 06268

Gene Ohashi
26 Archerhill Drive
Islington, Ontario
Canada M9B 5P3

Altair 8800-B -CONTINUED FROM PAGE 5 -

The "B" employs a new heavy duty power supply that provides the following voltages:

- +8 volts at 18 amps
- +18 volts at 2 amps
- 18 volts at 2 amps

The 8-volt secondary has 3 taps so that the output voltage may be maintained between 7.5 volts and 9 volts over the load range of 1 - 18 amps. The +18 and -18 volt supplies are both pre-regulated (zener diode and pass transistor) to maintain a reasonably constant voltage over their respective load ranges (0 - 2 amps). The transformer has a multiple tapped primary that allows either 110 volt or 220 volt AC (50/60 Hz) operation. It also allows for "low line" (100/200 volts) and "high line" (130/260 volts) adjustment.

The CPU board for the "B" has been redesigned to incorporate the Intel 8224 clock generator chip and 8216 bus drivers. The 8224 uses an

18 MHz crystal and internal counter so that the clock pulse widths and phasing as well as frequency are crystal controlled. The 8224 also provides for proper synchronization of the READY and RESET lines to the 8080 processor. The 8216 drivers guarantee that the 8080 input high voltage spec of 3.3 volts (minimum) is satisfied.

Compatibility: All current ALTAIR software will run on the "B" and all 8800 plug-in cards (except the CPU board) are compatible with the "B". The current ALTAIR bus has been maintained with the addition of four lines:

- a) Status Strobe which is generated by the 8224
- b) Data input gating control which determines which set of data drivers control the input bus.
- c) Two additional "READY" inputs.

Update Kit:

MITS will offer a "8800-B Update Kit" that will enable current 8800 owners to update their machines to a "B". The kit will include the new CPU board, new front panel and new power supply. The update kit will NOT include the 18-slot mother board, because of the cost of replacing the edge connectors. However, an 18-slot mother board kit may be offered later on.

Anyone who currently has an 8800 on order that has not been delivered may change their order to a 8800-B. Customers who change their order will however be billed for the price difference and should expect a longer delivery time. Prices and delivery dates for the 8800-B are not being announced at this time. Check next month's C/N for more information as it becomes available.

MARCH SOFTWARE CONTEST

by Paul Allen

This month a grand total of 30 (thirty?) programs were accepted into the Altair Software Library.

It is interesting to note the number of subroutines and extra features that have been submitted for the popular JAMON monitor program. So far, hex input and output modifications, a memory test, breakpoint routines and more have been sent in for this month alone.

First Place Major Program goes to Joe Konard for his paper tape labeling program (#3-16-761) written in ALTAIR BASIC. This program demonstrates good use of the WAIT and OUT statements, as well as string manipulation.

Second Place Major Program goes to John Budnick's MASTERMIND program (#3-9-763), a very interesting game that is written in machine language.

Third Place Program goes to David Welter for his IBM system 360 assembler (#3-15-761). I once wrote a similar set of macros for the 8008; cross assemblers like this which allow full access to a large machine's assembler can be extremely useful when writing programs for a micro-processor.

First Place Subroutine goes to Christopher Flynn for his well-documented and useful subroutines for ALTAIR BASIC (#3-12-763). These routines allow programs to be saved on cassette in ASCII form, instead of the binary format used by BASIC's CSAVE and CLOAD commands. Also, these routines can be used with 4K BASIC, giving the 4K BASIC user the option of saving and loading programs on cassette.

Second Place Subroutine goes to Ian Kettleborough for his relocatable checksum loader (#3-4-761). This program loads ALTAIR format checksum tapes but also can relocate itself anywhere in memory to "keep away" from the code being loaded in. A relocatable boot loader is also given.

Third Place Subroutine goes to Harold Corbin for his plotting program in ALTAIR BASIC (#2-27-761).

FIRST PLACE MAJOR PROGRAM

#3-16-761

Author: Joe Konard
Length: 72 lines (ALTAIR BASIC)
Title: PAPER TAPE

This well written program punches paper tape labels in human readable format.

SECOND PLACE MAJOR PROGRAM

#3-9-763

Author: John E. Budnick
Length: about 350 bytes
Title: MASTERMIND
Game where player attempts to break a code devised by other player (ALTAIR). Needs a terminal.

THIRD PLACE MAJOR PROGRAM

#3-15-761

Author: David D. Welter
Length: 726 lines (IBM 360 Assembler)
Title: ASM8080
Cross-assembler for the ALTAIR 8800 written in MACROs in system 360 assembly language.

FIRST PLACE SUBROUTINE

#3-12-763

Author: Christopher J. Flynn
Length: about 100 bytes
Title: ASCII ACR I/O routines
Modifications to MITS ALTAIR BASIC which allow programs to be saved on cassette in source (ASCII) form.

SECOND PLACE SUBROUTINE

#3-4-761

Author: Ian Kettleborough
Length: 201 bytes
Title: Binary Loader
Modified version of MITS checksum loader which will automatically relocate itself to any area of memory.

THIRD PLACE SUBROUTINE

#2-27-761

Author: Harold Corbin
Length: 46 lines (ALTAIR BASIC)
Title: XYPLOT
Produces an X-Y plot of a single valued function.

#3-1-765

Author: Harold Corbin
Length: 26 lines (ALTAIR BASIC)
Title: LIFE
Plays popular LIFE game.

#3-2-761

Author: Alan R. Miller
Length: 122 bytes
Title: HEXMON
Allows JAMON (#117752) to accept and output information in hex for the L, D, or G commands.

#2-23-761

Author: Bill Thompson
Length: Approximately 250 lines (BASIC)
Title: Astronomical OPTICS
Computer Ray trace. Needs about 12K with 8K BASIC.

#2-24-761

Author: Robert Riskin
Length: 12 lines
Title: FRETS
This program calculates and prints the distances of any number of frets from either the neck or bridge of a musical instrument of any scale length, rounded to two places.

#2-26-761

Author: Martin H. Eastburn
Length: 56 bytes
Title: Distribution Analysis
This program sorts through a string of bytes while keeping track of the quantity of each possible number encountered.

#2-26-762

Author: Jerry A. Ford
Length: 28/33 bytes
Title: TDUMP/TLOAD
Memory dump/load routines to use with JAMON.

#2-26-763

Author: Jerry A. Ford
Length: 121 bytes
Title: JABUG
Simple breakpoint routine which types out registers.

#3-1-764

Author: Harold Corbin
Length: 60 lines (ALTAIR BASIC)
Title: BIORYTHM
Produces biorythm plots.

#3-1-763

Author: Roger Walker
Length: 83 bytes
Title: CDUMP
General purpose routine to dump memory in MITS binary checksummed format.

#3-1-761

Author: Amos D. Conard
Length: 21 lines (ALTAIR BASIC)
Title: NUMGUESS
Simple number guessing game.

#3-1-762

Author: Robin Myers
Length: 73 bytes
Title: BRIDGET
Plays game of BRIDGET. No I/O device needed.

SOFTWARE

680 SOFTWARE DEVELOPMENTS

by Mark Chamberlin

680 PROM Monitor

Paul Allen and I have spent many long hours applying the shoe horn to the 680 PROM Monitor in an effort to pack as many features as possible into the 256 byte PROM. Our efforts have resulted in what I consider to be the best 6800 monitor of its size.

The Monitor, which is brought to life simply by activating the Power, Reset, and Run switches on the front panel, provides the capabilities to load binary paper tapes into RAM, examine and/or modify a specified memory byte, examine and/or modify the next sequential memory byte, jump to any address in memory, set program breakpoints, and continue program execution after a breakpoint.

In fact, at this point the only thing the 680 PROM Monitor doesn't have is a name. If you have a clever idea for a name (something really catchy) please drop me a line here at MITS.

Baudot Teletype Option

A Baudot (5 level code) to ASCII conversion program has been written and will be available on a 256 byte PROM. The Baudot character set has been extended by means of character combination to include all commonly used ASCII characters as well as control A through Z. A special version of the PROM Monitor must be used in conjunction with the Baudot PROM and, therefore, the Baudot option should be specified when ordering a 680. However, it will be possible to return the standard PROM Monitor chip for reprogramming when ordering the Baudot PROM.

680 Resident Assembler

The ALTAIR 680 has a powerful 2 pass assembler which resides in approximately 5K bytes of RAM. A full assembly listing may be obtained with an additional pass on a system having a controllable paper tape reader. I'm presently working on options to provide capabilities for assembling a program in the Edit Buffer (created by using the 680 Resident Editor) and getting a full assembly listing on a system without a controllable reader by holding the source in RAM during assembly.

Next month I'll delve into the features of the 680 Text Editor and include an example of its use. In

Sample Program Assembly Using 680 Resident Assembler

```

00001      NAM      MEMTEST      PRINT SYMBOL TABLE
00002      OPT      S              NON-PAGINATED LISTING
00003      OPT      NOPAGE
*
* AN "*" IN COLUMN 1 INDICATES A COMMENT LINE
* MEMORY TEST PROGRAM
* READS THE ADDRESSES OF THE FIRST & LAST
* MEMORY LOCATIONS TO BE TESTED
*
*
*      ORG      $14      INIT LOCATION COUNTER
* "$" INDICATES HEX NUMBER
00011 0014  STACK EQU      *
00012      *      IS CURRENT LOCATION COUNTER
00013      *      WHEN USED IN OPERAND
00014 0014
00015
00016
00017      OUTCH EQU      $FF89
00018      OUT2H EQU      OUTCH-18
00019      * DEFAULT RADIX IS 10
00020      * NOTE EXPRESSIONS CAN BE USED
00021      BADDR EQU      $FF6A
00022      OUTS EQU      $FF8A
00023      MONIT EQU      $FFCB
*
* OUTCH, OUT2H, OUTS, AND BADDR ARE SUBROUTINES
* IN THE PROM MONITOR
* A FULLY DOCUMENTED SOURCE COPY OF THE PROM MONITOR
* IS INCLUDED IN THE 680 SOFTWARE MANUAL
*
*
00031 0014 0001 XHIGH RMB      1      RESERVE MEMORY BYTE
00032 0015 0001 XLOW  RMB      1
00033 0016 0002 LSTBYT RMB      2      LAST BYTE TO CHECK
00034
00035 0018 8E 0014 GO      LDS      #STACK  INIT STACK POINTER
00036      * "?" INDICATES IMMEDIATE ADDRESSING
00037
00038
00039 001B BD 0051 JSR      GETADR
00040 001E DF 14 STX      XHIGH
00041
00042 0020 BD 0051 * GET ADDRESS OF LAST BYTE TO CHECK
00043 0023 DF 16 JSR      GETADR
00044 0025 DE 14 STX      LSTBYT
00045      LDX      XHIGH
*
00046 0027 5F NXTBYT CLR B
00047 0028 E7 00 NXTPAT STA B      X      WRITE TEST PATTERN
00048 002A E1 00 CMP B      X      CHECK WRITTEN PATTERN
00049 002C 27 18 BEQ      OKMEM   DID WE READ WHAT WE WROTE?
00050 002E 96 0D LDA A      $1101 NO,SEND CR AND LF
00051
00052      * "%" INDICATES BINARY NUMBER
00053 0030 BD FF89 JSR      OUTCH
00054
00055
00056
00057 0033 96 0A LDA A      @12      "@" INDICATES OCTAL NUMBER
00058 0035 BD FF89 JSR      OUTCH
00059 0038 DF 14 STX      XHIGH      STORE X REGISTER
00060 003A D6 14 LDA B      XHIGH
00061 003C BD FF77 JSR      OUT2H      PRINT HIGH BYTE OF ADDRESS
00062 003F D5 15 LDA B      XLOW      PRINT LOW BYTE OF ADDRESS
00063 0041 3D FF77 JSR      OUT2H      OUT2H PRINTS 2 HEX DIGITS
00064 0044 20 03 BRA      BUMP      DONE WITH THIS BYTE
00065 0046 5C OKMEM INC B
00066 0047 26 DF BNE      NXTPAT  INCREMENT TEST PATTERN
00067 0049 08 BUMP INX
00068 004A 9C 16 CPX      LSTBYT  ALL PATTERNS TESTED?
00069 004C 26 D9 BNE      NXTBYT  YES, BUMP BYTE POINTER
00070 004E 7E FFCB JMP      MONIT   YES, RETURN TO PROM MONITOR
*
*
* SUBROUTINE TO GET ADDRESS INTO X REG
*
00075 0051 BD FF8A GETADR JSR      OUTS      PRINT A SPACE
00076 0054 86 3F LDA A      #'?      PRINT A QUESTION MARK
*
* "" INDICATES AN ASCII LITERAL
*
00080 0055 BD FF89 JSR      OUTCH
00081 0059 BD FF6A JSR      BADDR
*
* BADDR READS A 4 DIGIT HEX NUMBER
* FROM THE TELETYPE INTO THE X REG
*
00086 005C 39 RTS      RETURN TO CALLING PROGRAM
*
*
*      END
STACK 0014
OUTCH  FF89
OUT2H  FF77
BADDR  FF6A
OUTS   FF8A
MONIT  FFCB
XHIGH  0014
XLOW   0015
LSTBYT 0016
GO     0018
NXTBYT 0027
NXTPAT 0028
OKMEM  0046
BUMP   0049
GETADR 0051
TOTAL ERRORS 00000

```

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CLASSIFIED ADS

For Sale: MITS 88-SIOA RS-232 Serial I/O interface for Altair 8800, \$80, assembled. 88-MCS 256-byte static memory, \$60, assembled.
Contact:

David Richards
6655 Hill St.
El Cerrito, CA 94530
(415) 529-0759-evenings.

For Sale: Hexadecimal Calculator/Converter: 8 digits, credit balance-complement, leather case, \$35.95. Octal version \$14.95. Send for free literature, Radix Precision Co., Box 13861-CN, Atlanta, GA 30324

For Sale: Model 32 teletype in mint condition. Contact RADEC, Inc. 5575 Poplar, Suite 810, Memphis, TN 38117, Phone (901) 761-0281.

For Sale or Trade: Singer Panoramic Spectrum Analyzer. Need I/O device for ALTAIR 8800, prefer Mod. 33 TTY. Contact Roderick W. Hart WA3MEZ, 9841 Branchleigh Rd., Randallstown, MD 21133 (301) 655-0393.

Wanted: Used 5-level teletype. Contact Kenneth Aird, Antioch Student Mailroom, Antioch College, Yellow Springs, OH 45387

Wish to contact other Ham ALTAIR Users to discuss Ham Radio applications, especially RTTY. Contact Roderick W. Hart, WA3MEZ, 9841 Branchleigh Rd., Randallstown, MD 21133 (301) 655-0393.

FOR SALE: Tally Reader and Punch Combination Model 420 and 424. Used good condition, \$150.00.

L. F. Carbaugh
PO Box 398
New Cumberland, PA 17070

FOR SALE: \$75.00--2K byte MONITOR for 8008 system. Routines include: Symbolic program input, Edit, Load and Dump Octal, cassette routine, and more. Call or write for complete information:

Kent Kersten
711 Ronnie Rd.
Madison, TN 37115

SOFTWARE: If you need application programs written in BASIC (or any language on request) contact:

Mr. Kim Dildine
Dildine, Inc.
9126 Indianapolis Blvd.
Highland, IN 46322
(219) 923-6254

FOR SALE: 8080 Pocket Reference Cards. Mnemonics, flags, conversions, etc. \$1.25 for one card, \$5.00 for five cards. Contact:

8080 Card
29 Hoyt St.
Stamford, CT 06905

Altair Floppy Disk
- continued from page 6

LINE [#] {file number},
INPUT {string variable}
Reads the complete character string up to a carriage return, into the string specified. LINE INPUT without a file number may be used to read a string from the user terminal.

GET [#] {file number}, {record number}
Performs a random read of the nth record of the file into the random file buffer associated with {file number}.

PUT [#] {file number}, {record number}
Performs a random write of the random buffer associated with {file number} to the nth record in {file number}.

FIELD [#] {file number}, {numeric formula} AS {string variable},
[, {numeric formula}]
Associates {numeric formula} bytes in the disk buffer with the {string variable} given. Subsequent CSETs and RSET may be used to place data in the random buffer, while a random read will automatically assign byte strings to string variables that have "FIELDed" into the buffer.

END and NEW both close all files.

LOAD {file name}, {disk number}[,R]
The LOAD command loads a program file into memory from {disk number}. The optional R at the end may be used to RUN the program after it is loaded. The old program and all variables are erased. LOAD can be given in a program.

SAVE {program name}, {disk number}
[,A[{line range}]]
The SAVE command saves the program on the {disk number}. The optional A can be used to save the program file in ASCII source format (using the optional line range). Otherwise, the program is saved in compressed image format, which requires less disk space and loads more quickly.

FUNCTIONS

MKI\$ ({integer formula})
Returns a two byte string containing the binary representation of the {integer formula}.

MKD\$ ({double precision formulas})
Returns an eight byte string containing the binary representation of the {double precision formulas}.

MKS\$ ({single precision formula})
Returns a four byte string containing the binary representation of the {single precision formula}.

CVI ({string formula})
Returns an integer value which is obtained from the first two bytes of {string formula}.

CVD ({string formula})
Returns a double precision value which is obtained from the first eight bytes of {string formula}.

CVS ({string formula})
Returns a single precision value which is obtained from the first four bytes of {string formula}.

CVI, CVS, CVD file a "function call" error if the string argument is too short.

DSKF ({disk number})
Returns the number of free sectors on {disk number}. The disk must be mounted.

EOF ({file number})
Must be a sequential input file and returns a true (-1) if end of file is detected on {file number}. False (0) otherwise.

LOC ({file number})
Returns the current record number read or written on {file number}. For random files, gives the record that will be accessed if a GET or PUT without a record # is used.

LOF ({file number})
Must be a random access file and returns the last record number written on the random file {file number}. Always = 5 MOD 8.

Software Contest

-continued from page 8

#2-18-761

Author: Jack O. Coats, Jr.
 Length: 53 bytes
 Title: 5BCDBIN
 Converts a 5-digit BCD number in memory to a 16-bit integer value.

#2-18-762

Author: R. H. Hann
 Length: 126 lines (BASIC)
 Title: Tic-tac-toe
 This "heuristic" (learning) program plays tic-tac-toe.

#2-18-763

Author: L. M. Eastburn
 Length: 319 bytes
 Title: TTY Utility
 This is a general purpose program to use a TTY and VLCT. One can have the program type a variety of repetitive remarks like XMAS greetings. It provides routines that will back-space and execute TAB functions on a TTY.

#2-20-761

Author: Joe W. McCarty
 Length: 223 bytes
 Title: FIFO
 General purpose routines to implement any number at stacks, to check when stacks are full, PUSH and POP entries on stacks, etc.

#2-20-762

Author: Jack O. Coats, Jr.
 Length: 15 bytes
 Title: Computed GO TO
 Branches to the nth address following the subroutine call. Destroys PSW, A, H, and L.

#3-9-761

Author: Alan R. Miller
 Length: 63 bytes
 Title: Memory Check
 Memory test for use with JAMON. Count test (writes 0-377 octal in every byte in memory.)

#3-3-761

Author: Henry E. Lacy
 Length: 75 bytes
 Title: Security Access Routine
 Subroutine for use with JAMON which verifies a 5-character password before allowing the user access to the system.

#3-12-761

Author: R. H. Hann
 Length: 152 lines (BASIC)
 Title: STAR TREK
 Plays a game based on the popular TV show.

#3-16-762

Author: Erik T. Mueller
 Length: 129 bytes
 Title: Rocket
 Plays "lunar lander program" on a TVT-II.

#3-16-763

Author: Erik T. Mueller
 Length: 182 bytes
 Title: ESMO
 Very compact monitor. Has commands for entering and dumping memory locations in octal, and for starting program execution at a specified location.

#3-12-762

Author: R. H. Hann
 Title: TIC-TAC-TOE
 Plays tic-tac-toe.

#3-9-762

Author: Alan R. Miller
 Length: 19 bytes
 Title: Memory Preset
 Sets a block of memory to a predefined value.

altair disk specifications

Rotational	360 rpm (166.7ms/rev)
Access Times	Track to track, 10 ms Head settle, 20 ms Head load, 40 ms Average time to read or write, 400 ms Worst case, 1 sec
Head Life	Over 10,000 hours of head to disk contact
Disk Life	Over 1 million passes/track
Data Transfer Rate	250K bits/sec
Power Consumption	117VAC 110W
Diskette	Hard sectored, 32 sectors per track + index, Dysam 101 floppy disk, 77 tracks/diskette
Price	88-DCDD (Disk Controller, one Disk Drive, Diskette and interconnect cable) -- \$1480.00 kit -- \$1980.00 assembled 88-Disk (one Disk Drive, Diskette and interconnect cable) -- \$1180.00 kit -- \$1600.00 assembled Disk Extended BASIC -- \$450.00 Disk Extended BASIC, for purchasers of Altair 8800 and 15K of memory -- \$200.00

Teletype special

If you are planning on taking advantage of the Teletype offer announced in the January, 1976 issue of C/N,
 --TAKE NOTE--

Teletype Corp. has advised us that this special offer can apply only when shipment is to be made inside the continental United States. Therefore, the discount prices cannot be extended to overseas customers or to those living in Alaska and Hawaii.

680 Software Developments
-continued from page 9

closing I would like to encourage all mathematicians and/or logical thinkers (this means you!) out there in computer land to consider the following statements:

- 1) Nothing is impossible.
- 2) It is therefore impossible for something to be impossible.

It is my contention that statement 2, which is a direct result of statement 1, proves that statement 1 is false by showing that something is impossible. This should be intuitively obvious to the most casual observer. Eddie Currie (MITS Senior Vice-President) and Paul Allen (Director of Software) are not convinced so I need someone to provide a formal mathematical proof. I will be overjoyed to receive confirmation of my argument and reluctant, but willing to receive proof of my incorrectness.

Can anyone beat the Altair System?



We doubt it.

When it comes to microcomputers, Altair from MITS is the leader in the field.

The Altair 8800 is now backed by a complete selection of plug-in compatible boards. Included are a variety of the most advanced memory and interface boards, PROM board, vector interrupt, real time clock, and prototype board.

Altair 8800 peripherals include a revolutionary, low-cost floppy disk system, Teletype™ line printer, and soon-to-be-announced CRT terminal.

Software for the Altair 8800 includes an assembler, text editor, monitor, debug, BASIC, Extended BASIC, and a Disk Operating System. And this software is **not just icing on the cake**—it has received industry wide acclaim for its efficiency and revolutionary features.

But MITS hasn't stopped with the Altair 8800. There is also the Altair 680—complete with memory and selectable interface—built around the new 6800 microprocessor chip. And soon-to-be-announced are the Altair 8800a and the Altair 8800b.

MITS doesn't stop with just supplying hardware and software, either. Every Altair owner is automatically a member of the Altair Users Group through which he has access to the substantial Altair software library. Every Altair owner is informed of up-to-date developments via a free subscription to **Computer Notes**. Every Altair owner is assured that he is dealing with a company that stands firmly behind its products.

After all, we didn't become the leader by messing around. Shouldn't you send for more information or visit one of our Altair dealers?

Altair Coupon

Please send me the following information:

- Your latest catalog and price list
- Software information package
- Please include a list of your dealers

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ADDRESS _____

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STATE & ZIP _____



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