

Mini-Minutes

March 5, 1990

Dave opened the meeting of 25+ members promptly at 7pm.

The first order of business on the agenda was the appointment of members for the nomination committee. The following members volunteered to serve and contact the members and fill the ballot positions. Rich Lindway Terry Longenecker Bill Robinson

Chet Argast

The nominations will be closed at the April meeting with ballots sent to every member in good standing as of the April meeting. The ballots will be counted at the May meeting with the new officers exchanging seats with the current board members at that meeting.

Barry apologized for not having the new issue of Micropendiums for the members. He said that he had called Texas and was told by Laura Burns that a death in John's family had delayed production. All copies were mailed but because of the holiday (Presidents' Day), we had not received ours. Secr note: Came in two days later.

A new magazine was introduced to the Group. "Computer Buyers Guide" The publishers indicated they will take up where "Computer Shopper" stopped. They will have the TI-FORUM etc columns. Look for it at the local news stores.

The Boston Computer Society will hold their annual TI-FAYAH on the 28th of April. A flyer was left on the table for any member to look at.

The annual TICOFF will be held on Saturday, March 17th in Roselle Park, New resey. Several members have expressed an interest in attending and we might Jersey. Severa attend together.

Asgard Software is producing a "mouse" for the TI and the Geneve. Retail price of \$54.95, including the drivers. They are also going to continue production of the 80 col card that was originally manufactured by Mechatronics. No price as of yet, but rumored to be less than the original

Tony spoke on the EXPO. The announcement is in the Feb issue of Micropendium. Over 100 flyers and registration forms were mailed out to local/national vendors. Tony is still needing volunteers!

After a short break, members gathered around the computers and observed various demonstrations.

The meeting adjourned at 9pm.

TIll next TIme.

Barry Long, Secretary

Next meeting May 7, 1990.

The Executive Washroom by Da_Prez, Dave Ratcliffe C.P.U.G., Harrisburg, Pa.

REMINDER TO THE MEMBERS! You'll all be getting your ballots for the new officers between now and the May meeting. Vote early and VOTE!!!!! Remember, you're picking the people who will be running YOUR User Group for the next

Well, 3 of your co-members made the long trek to New Jersey for T.I.C.O.F.F. on March 17th. We didn't see Jimmy Hoffa, in whole or in part, but we DID see something that will interest lots of people. The NEW Rave 99 Peripheral Expansion Box. When I first saw it, I told John McDevitt it was 'pretty' and I wasn't kidding. This unit will serve both TI AND Geneve owners since it includes a place inside for the mother board from a TI and the TI option will include the RAVE Keyboard interface: The box includes the following:

1) Room for 8 cards (same as TI PEB).
2) Room for FIVE disk drives!
3) Front panel power switch

3) Front panel power switch
4) Front panel keylock
5) Hard drive activity light
6) Front panel reset switch

7) 200 watt power supply 8) Cartridge port access from right side 9) Ellimination of the 'firehose' for the TI

ESTIMATED costs are:

For TI/99 - - - - \$300.00 For Geneve - - - \$250.00

Remember, these are only ESTIMATED prices and may fluctuate up or down depending on many variables. John's prototype provoked lots of interest and several suggestions for modifications and/or improvements. I have already started saving my \$\$\$ for one.

Lou Phillips was also there, looking a little shell-shocked. He's a new Daddy so I guess it's understandable. Naturally, I asked him about MDOS for the hard drive (at level .97h at this writing). Seems there are 2 versions floating around. One for the Horizon RAMdisk and one for standard system. The one for the HRD will lock up the system if you try to catalog a hard drive with MDMV. The other one works fine without a HRD. I don't have a HRD and guess which version of MDOS I got from GEnie... Don't ask. According to Lou, it SHOULDN'T be long for the release of .98h.

The Streamer Tape software nears completion (according to Lou). Messages on Delphi indicate John Birdwell is waiting for some necessary info from Myarc before he can continue. The wait continues. Pascal is STILL coming (so's Christmas). Advanced Basic? I didn't ask and until I get a usable MDOS for the HFDC, I'm not touching it. Lou DID tell me there is a C compiler in the works. It is very nearly a FULL implimentation of standard C (as opposed to small 'c' from Clint Pulley) so code from other systems should be more transportable. Who knows if it's vaporware or not? It sure SOUNDS interesting, at least to me. With the Unix system the BBS is running on, I'm being forced into C rather rudely. A package like this would be a big help for me.

The rest of the show was mostly PC stuff (hard drives and tape drives) with a couple of TI software vendors and TI UG's thrown in. There were lots of floppy drives for sale (360k DS/DD) at VERY reasonable prices but I saw the RAVE P-box first so my money is safe :-)

That's all I have for this month. Next month we'll be installing a new "Prez" for the group. If our esteemed Editor will permit, the Exec. Washroom will continue after I leave office, it just won't be the Prez's column any more. Maybe I'll even have time to write something intelligent occassionally <grin>.

>> Dave <<

Letter from the Editor or In the dumper, again... by Richard Lindway.

TI-COFF was really nice, you should have been there. There was probably close to a few THOUSAND square feet of floor space for user groups and vendors. Over 60 tables with hardware, software, books and other miscellaneous computer related items. Even though there were a few other computer types (no names mentioned), I feel that TI had the highest percentage of table space (although, not a majority). And we got to see some friends from other user groups again. It's a way to attempt to renew old relationships. relationships.

And, of course, there were TI hardware/software vendors: Bud Mills with his Horizon ram disks and P-Grams, Lou Phillips with his 9640, and other software/ hardware vendors plus some users groups showing and selling whatever they could. But in my opinion, show stopper was the new peripheral expansion box (P-box) from Rave. Really nice. It has room for eight cards, just like the old P-box, but there is more. A couple hundred watt power supply, room for a hard drive (maybe two or three), a place to install the main board for the 4A (the 9640 uses one of the card slots) and the best part, with a slight change, space for up to FOUR floppy drives. All of this in ONE BOX! It also has a nice metal cover strong enough to hold a decent sized monitor. And with the key board in front of you, you are set and ready to roll.

Maybe most if not all of these people will show up for our show in October and it will be just great. Don't worry folks, our TI isn't dead. It's not even really dying. It's still alive and well and livinging our homes and our hearts. Later...Rich.

hearts. Later...Rich.

TIPS and TECHNIQUES or How did you do that?

The tip for this month is an article on disk, disk controllers and they work. Hope you like it.

*************** SHOW BIZ NEWS ***************

By Tony De Donatis Sr. Show Chairman

As you all know by the past news letter and my little talk at the February and March meetings that the date and time for the show is set for SUNDAY, OCTOBER 14, 1990 from 7am - 3:30pm, only 8 1/2 hours long. This doesn't mean that we (the committee) only have 8 1/2 hours of work to do. If you think so, then you are kidding yourself!! The committee will have a minimum of 1000 hours, if it will stop at that, in planning and actual physical work before the show opens the doors.

What I am asking for, is a L I T T L E H E L P !!! I will be straight foward with you members and ask for VOLUNTEERS to help on the night before with setting up from scratch for the first time in this location, and the day of the show, and also to tear down and clean up that evening.

If I don't get volunteers to help with the work, then Iam going to play "Uncle Sam" and volunteer you individually just as the military does. If you don't understand, I will assign certain time and duties for each member to be there and help. So PLEAGE don't make me play UNCLE SAM. Remember this is YOUR CLUB! You only get out of it what you put in it, it is just like a computer, GARBAGE IN GARBAGE OUT, NO DATA IN NO DATA OUT, get the drift?

The following work committee chairpersons listed will need help, so pick your joh, then take a minute to jot your name, job and the time your are available on paper and mail it to the address shown on the news letter or give it to me at the meetings.

THE FOLLOWING IS A LIST OF JOBS AND THE CHAIRPERSON:
1. TICKETS Dottie Henry Swartz
2. SETUP TEARDOWN Terry Longenecker
3. FOOD CONCESSION Amos Meyers Corky Downey
4. ELECTRICAL Bill Robinson
5. ADVERTISING "Monti" Monoriti
6. GENERAL LABOR POOL Tony De Donatis Sr.

Remember to V O L U N T E E R !!! If you don't you are letting the "CLUB" including your self DOWN.

Disk Controllers - from TI to MYARC Copyright Jerry Coffey, January 1987
The views expressed in this article reflect the author's personal experience with TI, Corcomp, and Myarc disk controllers. Technical data has been verified wherever possible, but is not publicly documented in some instances. Please bring any errors to the attention of the author. The disk capacity of the TI99 has increased in just a few years from less than 80K (a single one-sided 35 track drive) to almost 2.9 megabytes (four double-sided, double-density, 80 track drives). The early standalone was replaced by the PEBox system which would support three double-sided 40 track drives(540K). Corcomp introduced their four drive double-density system (1440K), followed by Myarc's similar system with two double-density formats (1280K and 1440K). Then in 1986, Myarc offered its 80 track upgrade which doubled capacity again. Even as capacity was increasing rapidly, the TI and Corcomp controllers differed only modestly in I/O speed. When MYARC introduced its fast DSDD controller, few reviewers did justice to its speed advantage. Early comparisons were done at the standard TI or Corcomp interlace, but the big speed gains required taking advantage of the much tighter sector interlace possible with the high-speed MYARC card. To understand how this works we need to take a look at the way a disk drive performs. performs.

Disk Drive Fundamentals
A floppy disk drive writes information in concentric rings called "tracks"
on a thin plastic disk coated with a film of magnetic particles. Each track
in turn is divided into blocks of information called sectors. A blank disk
has one (or more) index holes used to synchronize the process of writing to
and reading from the disk. The type with many holes are called "hard
sectored" since each sector has its position fixed by an index hole. The type
of disks used by most computers have only one hole and are called "soft
sectored". In this system the computer must write magnetic signposts on the
disk to mark out each sector in a process called "formatting" or
"initializing" a disk. These signposts take up a substantial fraction of the
space on a track since they include not only sector numbers but buffers
(filler bytes) that allow the computer to get into synchronization to read or
write sectors of data and to prevent the sector identifier from being
overwritten by a drive operating at a slightly different speed from the drive
that formatted the disk. Disk Drive Fundamentals

The typical 5.25 inch disk drive has a "stepper motor" capable of moving the drive's read/write head(s) in or out along a radius of the disk in steps of 1/48 of an inch (thus the terminology "48 tpi" = 48 tracks per inch). Since the inner tracks have a smaller circumference, they crowd the bits of information together. Magnetic coatings on a floppy disk are rated by their capacity in bits per inch at standard magnetic flux for the write head. This figure is usually over 5000 bpi for modern floppies, but was somewhat lower a few years ago. The circumference of the inner track of a 40 or 80 track disk is about 10 inches -- which allows about 6250 bytes to be written on the track without exceeding 5000 bpi. For comparison, the Corcomp double density format requires over 6400 bytes per track. Media limitations were the reason that some early 5.25 disk drives only used the outer 35 tracks. The 16 sector (by 256 bytes/sector) format recommended by most drive makers requires only 6250 bytes per track and includes several hundred additional "buffer" bytes to compensate for difference in drive timing.

Timing is EVERYTHING With soft-sectored disks, the integrity of the read/write processes require critical timing. The disk rotates at 300 rpm within a small margin. This means there are about 250 thousand magnetic pulses (bits) passing beneath the head each second. In single density format, the majority of these pulses are timing or filler bits — in double density, many of the timing bits are suppressed in order to double the rate of data bits. In a typical sector read the drive must bring the disk up to speed, recognize the index hole, step out to track zero (to get its bearings), determine single or double density, verify its position, step into the target track, verify the track number (written in the format operation), detect the sector identifier as it flies past, then immediately read the 256 data bytes into memory. Five of these operations require accurate reading of the magnetic pulses whizzing by at over 250K bits per second. Timing is EVERYTHING per second.

If you do some quick arithmetic (256 bytes/sector = 2048 bits/sector into 250K bits/second). . . hmmm . . . Why can't the drive read a 125 sector file in one second? Well first, many of those bits are not data bits, they are overhead to keep things synchronized and allow for timing variation between drivers. Second, some time is used moving the head from one track to the next when more than one track must be read. Third, 250K is the instantaneous read rate and the computer must take time to do other things like move the last sector out of its buffer to make room for the next one. In the standard I Page 4

protocol for reading a disk, the data is moved into VDP ram (so the drive could be used without the memory expansion) before it goes to the expansion memory. All this thrashing eats great chunks of the time available for reading data. By the time one sector is safely tucked away in the 32K card, several sectors have already passed by the drive's read head. If the sectors were written consecutively on the disk, we would have to wait a full revolution (0.2 seconds) before the next sector would pass under the head. To avoid this inefficiency, the consecutively numbered sectors are spaced out around the disk so that they are separated by just enough time to take care of other business. The actual pattern in which the sectors are scattered is called the "interlace". The idea of the interlace is to spread the sectors out to match the timing needs of the hardware — both the time needed to stash each sector and the time needed to step from one track to the next and get the head settled down for some serious (250K bps) reading.

Interlace and Head Step Times

Life was simple with the TI disk controller. Both the interlace and the head step time were locked into the controller's PROM (that's the programmable chip that contains the control programs for the card). The head step time is the built-in delay between step signals to allow the stepper motor to move the head one "click" in or out. The TI settings are very conservative (read "slow") to allow for slow drives. The step time is 20ms -- if you step from track zero to track 39, it takes 20x39=780ms, almost four revolutions of the drive. The TI interlace lays the sectors down on a track in the order 075318642. This allows all sectors to be read in four revolutions of the disk though the slow head step lets another revolution go by between tracks. Thus the maximum read rate is about 9 sectors per five revolutions (= one second) or 2304 bytes per second.

When Corcomp designed its double density disk controller, allowances were made for the increased speed of later drives by permitting the step rate to be set with DIP switches for each drive. The step rates available are 30, 20, 12, and 6ms (the faster values quoted in the CC manual are referenced to the wrong clock speed). They also provided a choice of interlace options, though only a couple of them are practical. The default interlaces are labeled "7" for single density and "10" for double density. The single density interlace is the same as TI's, but with a faster step setting the head can be moved without losing a revolution and thus reads 20% faster than the TI controller. The double density interlace allows 18 sectors to be read in five revolutions, but it doesn't leave enough margin to stash the last sector and step the head in time to catch the zero sector of the next track (that's why the sector number "hangs" for 0.2 seconds each 18 sectors while verifying a formatted disk -- you are seeing the extra revolution needed to acquire the first sector of the next track). Thus the maximum read rate is 18/1.2 or 15 sectors per second, about 67% faster than the TI controller. Users of the CC controller have probably noticed that it loads its own MANAGER program faster than this. In this case a special loader bypasses VDP RAM -- this faster handling of the data allows the stepper motor to be activated sooner and saves one revolution per track (so the 98 sector file can be read in about 5.5 seconds). This provided a foretaste of the speed that MYARC would achieve with its double density controller.

The MYARC controller bypasses VDP RAM to load directly to CPU RAM. This technique coupled with a buffer RAM chip on the controller card provided a quantum jump in disk I/O speed. The MYARC card reads the TI single density interlace at 11.25 sectors/second (the same as Corcomp) and reads the CC 18 sector/track interlace at 18 sectors/second (the same speed Corcomp reads its MANAGER program), but this is only the beginning. Since the hardware empties its sector buffer faster, consecutive sectors can be placed closer together alowing a track to be read in fewer revolutions, i.e., it supports a faster interlace. With fast drives, the 9 sector/track single density format can be read at interlace "2". (NOTE: In the MYARC terminology, the interlace number represents the number of disk revolutions required to read a track.) This works out to 22.5 sectors/second compared to 9 for the TI and 11.25 for the CC controller. The MYARC 16 sector format can be read at interlace "3", 26.67 sectors/second — 3 times as fast as the TI controller and almost twice as fast as Corcomp double density. The Corcomp 18 sector format can be read at interlace "3" or "4", but the data rate is the same in either case, 22.5 sectors/second. Interlace "4" is smooth but requires a very quick head step, interlace "3" reads the track in 3 revolutions but forces an extra revolution for the step from track to track because sectors 17 and 0 are adjacent on the disk. Though both interlaces have the same data rate, interlace "3" is safer if you are uncertain about the speed of your stepper motor.

In order to read and write both double density formats, the MYARC system must insert an additional step in some I/O operations -- sector zero must be read to determine whether a double density disk has 16 or 18 sectors per track. This datum is needed to convert the logical sector numbers used by the TI operating system into track and sector-within-track addresses for the Page 5

floppy disk controller chip. The TI and Corcomp controllers do not need this step because they do not use the full potential of the TI disk I/O protocol. Once this step, accessing sector zero, is added to the various disk operations it opens the system up for using more than two formats -- including 80 track formats.

Beyond Double Density
A two format system can be mangaed using only the floppy disk controller's inherent ability to sense single and double density recording patterns. To get beyond this limitation, the additional data stored in sector zero must be read, stored, and used to modify the special binary commands sent to the FDC (floppy disk controller) chip. Fortunately the T199/4A system design already provides for such innovations through the Device Service Routine concept and standard "GPL" calls. The system doesn't care what hardware is attached as long as it plays by the rules -- an interface program stored in a memory chip (PROM) on the peripheral device does the trick. This program handles calls for I/O operations from other programs such as TI Writer or the Basic Interpreters. Another set of rules controls the way disk and file information are saved on a disk. Disk parameters are stored in sector 0, while sector 1 must have a two byte "pointer" (a hexadecimal sector address) for each block (one sector) containing the bookkeeping data for a file. It is these blocks that are scanned in order to display the disk directory.

Since the MYARC controller must read sector zero to determine the number of sectors per track, the other parameters in that sector are available to control other variables such as number of tracks. But there were other limitations to overcome. The number of files on a disk is limited by the space available for pointers. 256 bytes at 2 bytes per pointer would give 128 files -- except the pointer list must end with a null word (>0000) so directory routines know where to stop -- so we get 127 files per disk. The pointer itself can address sector numbers as high as 65535, so this is no problem. The real limitation is the bit map in sector 0. It begins at byte 56 leaving only 200 bytes of 1600 bits available to map the disk. Since a bit must be turned on for each sector used, the 1440 sector DSDD 40 track disk is already near the limit. The answer devised for the 80 track DSDD system is to map two consecutive sectors with each bit. It wastes some space but no more than systems that use a standard 512 byte sector.

Making the Quad System Work
So now lets say we have new code in the disk controller EPROM (an "erasable" version of the PROM chip used by TI) that does all the proper tricks with the bit map and has the FDC commands to control the new 80 track drives we have added to the system. We still have to tell the controller which drives are 80 track and find a disk manager program that can use the new commands. The selection problem can be taken care of using the DIP switches on the card (but in the process you lose their original function —— setting step speed). Since the Eprom responds to standard GPL calls, most functions can be handled by the TI Disk Manager 2 cartridge. The exception is the disk formatting process —— the formatting works OK, but the initial data written into sector zero is for the standard bit map. (This can be fixed by changing byte 56 from >03 to >01 with a sector editor.) Read/write operations from XB or TI Writer work fine since they use the GPL protocols. Myarc has an excellent disk manager program that works beautifully with 40 track drives, but it has suffered from a number of subtle bugs in 80 track mode. This program, like many others designed for high speed I/O, uses assembly language code to handle the FDC —— bypassing some of the routines in the EPROM. Differences in bit map handling, even slight differences in execution times can affect the performance of 80 track drives. The code in the 80 track EPROM has had a lot of attention to proper timing — the price you pay for higher performance.

Fine Tuning the Myarc Disk System
Before you start using the Myarc system routinely, there are some experiments that can get maximum performance from your drives. Use the Myarc disk manager to try different interlace settings — first with your 40 track drives, then with the 80 track drives. Watch for hesitations as each formatted disk is verified, then use the Test option to read the sectors you have laid down. Look and listen for "retries" — when the sector number pauses with a head seek noise. Use the best disk you have and note the combinations that test smoothly. With fast drives in good condition, you should be able to run 9 sector (single density) format at interlace 2 and 16 or 18 sector double density format at interlace 3. Don't worry if 18/3 pauses at the end of each track — this is just the extra revolution forced by having sectors 17 and 0 adjacent on the disk.

When you try this with 80 track drives, don't be surprised if the results are different. The time required for the head to settle into a wide standard

track may not be adequate to get it reading properly from the narrow tracks on the quad drive. Such subtleties as erase delays and disk quality are also more critical on the skinny, low power tracks. My Mitsubishi 4853s (96 tpi) will support both 16/3 and 18/3 but are unreliable at 18/4, while my TEAC 55Bs support all three at 48 tpi. Don't take chances with any setup that is marginal. The error rate may be low, but it always seems to happen to a file that isn't backed up.

Hot Rodding
If you want to try for a little more speed, there are two more tricks you can use. The faster WD1772 FDC chip is pin compatible with the standard WD1770 supplied by Myarc. It will try to step the head at 2ms rather than the 6ms setting of the standard chip. (The 80 track EPROM automatically uses the fastest step speed available.) Many of the latest drives can step at 2ms or 3ms even though they are conservatively rated at 4ms or 5ms. The change is noticeable but may not be worth the high price of the WD1772 (it is not a commonly used chip and is rarely discounted). The second fix is cheap and very useful for producing large quantities of copies. The FDC chip's automatic "write verify" function can be defeated by shorting one pin on the controller card to ground. This is best done with a switch so the verify can be enabled for normal operations. The effect of this modificationd is equivalent of the "turbo" option on the Corcomp controller and should be used only after testing.

Interlace Patterns

Note: The configurations marked * and ** are the standard interlace patterns for TI and Corcomp formats. The end-of-track intervals are only approximate since the 9 and 16 sector formats include more buffer space than the 18 sector format.

Sect Inter Pattern (dashed line is time available for head step) trk lace

4*	0		7		5		3		1		8		6		4		2	
2	0		5		1		6		2		7		3		8		4	
5**	0	11	4	8	15	1	12	5	9	16	2	13	6	10	17	3	14	7
4	0	9	5	14	1	10	6	15	2	11	7	16	3	12	8	17	4	13
3	0	6	12	1	7	13	2	8	14	3	9	15	4	10	16	5		17 none
5	0	13	10	7	4	1	1	4	11	8	5	2	15	1	12	9	6	5
3	0	11	6	1	12	7	2	2	13	8	3	14	9	4	15		10	5
	2 5** 4 3	2 0 5** 0 4 0 3 0 5 0	2 0 5** 0 11 4 0 9 3 0 6 5 0 13	2 0 5 5** 0 11 4 4 0 9 5 3 0 6 12 5 0 13 10	2 0 5 5** 0 11 4 8 4 0 9 5 14 3 0 6 12 1 5 0 13 10 7	2 0 5 1 5** 0 11 4 8 15 4 0 9 5 14 1 3 0 6 12 1 7 5 0 13 10 7 4	2 0 5 1 5** 0 11 4 8 15 1 4 0 9 5 14 1 10 3 0 6 12 1 7 13 5 0 13 10 7 4 1	2 0 5 1 6 5** 0 11 4 8 15 1 12 4 0 9 5 14 1 10 6 3 0 6 12 1 7 13 2 5 0 13 10 7 4 1 1	2	2 0 5 1 6 2 5** 0 11 4 8 15 1 12 5 9 4 0 9 5 14 1 10 6 15 2 3 0 6 12 1 7 13 2 8 14 5 0 13 10 7 4 1 14 11	2 0 5 1 6 2 5** 0 11 4 8 15 1 12 5 9 16 4 0 9 5 14 1 10 6 15 2 11 3 0 6 12 1 7 13 2 8 14 3 5 0 13 10 7 4 1 14 11 8	2 0 5 1 6 2 7 5** 0 11 4 8 15 1 12 5 9 16 2 4 0 9 5 14 1 10 6 15 2 11 7 3 0 6 12 1 7 13 2 8 14 3 9 5 0 13 10 7 4 1 14 11 8 5	2 0 5 1 6 2 7 5** 0 11 4 8 15 1 12 5 9 16 2 13 4 0 9 5 14 1 10 6 15 2 11 7 16 3 0 6 12 1 7 13 2 8 14 3 9 15 5 0 13 10 7 4 1 14 11 8 5 2	2 0 5 1 6 2 7 3 5** 0 11 4 8 15 1 12 5 9 16 2 13 6 4 0 9 5 14 1 10 6 15 2 11 7 16 3 3 0 6 12 1 7 13 2 8 14 3 9 15 4 5 0 13 10 7 4 1 14 11 8 5 2 15	2 0 5 1 6 2 7 3 5** 0 11 4 8 15 1 12 5 9 16 2 13 6 10 4 0 9 5 14 1 10 6 15 2 11 7 16 3 12 3 0 6 12 1 7 13 2 8 14 3 9 15 4 10 5 0 13 10 7 4 1 14 11 8 5 2 15	2 0 5 1 6 2 7 3 8 5** 0 11 4 8 15 1 12 5 9 16 2 13 6 10 17 4 0 9 5 14 1 10 6 15 2 11 7 16 3 12 8 3 0 6 12 1 7 13 2 8 14 3 9 15 4 10 16 5 0 13 10 7 4 1 14 11 8 5 2 15 12	2 0 5 1 6 2 7 3 8 5** 0 11 4 8 15 1 12 5 9 16 2 13 6 10 17 3 4 0 9 5 14 1 10 6 15 2 11 7 16 3 12 8 17 3 0 6 12 1 7 13 2 8 14 3 9 15 4 10 16 5 5 0 13 10 7 4 1 14 11 8 5 2 15 12 9	2 0 5 1 6 2 7 3 8 4 5** 0 11 4 8 15 1 12 5 9 16 2 13 6 10 17 3 14 4 0 9 5 14 1 10 6 15 2 11 7 16 3 12 8 17 4 3 0 6 12 1 7 13 2 8 14 3 9 15 4 10 16 5 11 5 0 13 10 7 4 1 14 11 8 5 2 15 12 9 6

16-sector patterns are not precisely to scale.

This comes to us from the Delaware Valley User's Group. A special thanks goes to Dotty Swartz for typing all of this in for me. [Ed]

WE'LL LOOK FOR

YOU

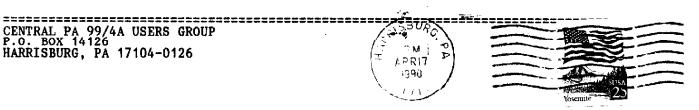
AT THESE MEETINGS

Circle your Calendar with these meeting dates

JANUARY FEBRUARY	5	JULY AUGUST	ţo	þe	announced
MARCH	5	SEPTEMBER	1111	17 11	16.17
APRIL	Ž	OCTOBER	11 11	11 22	19 11
MAY	7	NOVEMBER	78 17	1011	91 17
JUNE	4	DECEMBER	11 11	1111	1911

All meetings begin at 7PM but the Group equipment will be up and ready for use at approximately 6PM. All meetings are held at the CAMP HILL SHOPPING MALL COMMUNITY ROOM.

CENTRAL PA 99/4A USERS GROUP P.O. BOX 14126 HARRISBURG, PA 17104-0126



Dallas TI Home Computer Grp P.O. Box 29863 Dallas TX 75229

NEXT MEETING: MARCH 5TH 1990 at 7pm

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