NO. 48
NOVEMBER 1986

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THE #1 MAGAZINE FOR ATARI® COMPUTER OWNERS

ANALOG COMPUTING™

INCLUDING

ST-LOG
THE ATARI ST OPERATOR'S MAGAZINE

THIS MONTH:

- Atari status report
- Modem Chess
- Print graphics tutorial
- Reviews of peripherals

IN ST-LOG:

- Alert boxes
- C compiler reviews

11
74470 12385 9

The Flying Simulations Chosen by Real Pilots

The toughest evaluators of flying simulations aren't computer buffs. They're actual pilots and flight professionals. And when these flyers talk authenticity and realism, one name comes up again and again: MicroProse Simulation Software. We're used to this kind of stringent comparison; our company president is a former fighter jock with 3,000 flying hours in his logbook.

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Mr. Martin isn't the only pilot who's spent many of his recent leisure hours with MicroProse simulations. Comparing his experience in training real flyers with the instrument layout found in SOLO FLIGHT, Cessna Flight Instructor Mark Rice told us "the instrument flying segments are very similar to the real thing – you're up in the clouds and using your readings to guide the aircraft."

Concorde pilot and former RAF jet flyer John Hutchinson reviewed Micro Prose' sport flight ACROJET for the British press. His conclusion: "this simulation is one that really does live up to its real-life counterpart . . . I find ACROJET completely absorbing and very exciting." High praise, from the man who flies the world's fastest airliner . . .

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FEATURES

Status report . . . . . D.F. Scott 13
What does Atari really think of its 8-bit line? D.F. Scott gives us all an enlightening view, based on interviews with Atari's corporate insiders.

M-Windows . . . . . Kevin Ravenhill 15
Don't be left out. With **M-Windows** you can have "windows" on your 8-bit Atari—and up to 255 of these may be open simultaneously.

Bits & Pieces . . . . . Lee S. Brilliant, M.D. 29
This month, our continuing hardware feature gives you the necessary know-how to put together your own light pen for the 8-bit Atari.

ST-Log 45ST
ANALOG Computing's ST magazine. See page 47ST for contents of this month's **ST-Log**.

Cosmic Glob . . . . . Rich B. Enns 96
A one- or two-player game—use your spacecraft to wipe out the evil glob lurking in the void.

DLIs:
A minute to learn . . . . Jonathan David Farley 107
The second and final installment, delving straight into DLIs. In this issue, we'll be discussing how and where to manipulate them.

Modem Chess . . . . . Gary Heitz 119
Two-player chess—lets you play with an opponent who's a thousand miles away.

REVIEWS

Comp-U-Temp . . . . . Matthew J.W. Ratcliff 35
(Applied Technologies, Inc.)
Connect up to sixteen temperature sensors to your computer.

Panasonic KX-P1092 . . . . . Pamela Rice Frank 39
(Panasonic Industrial Co.)
A look at a printer gaining popularity among Atari users.

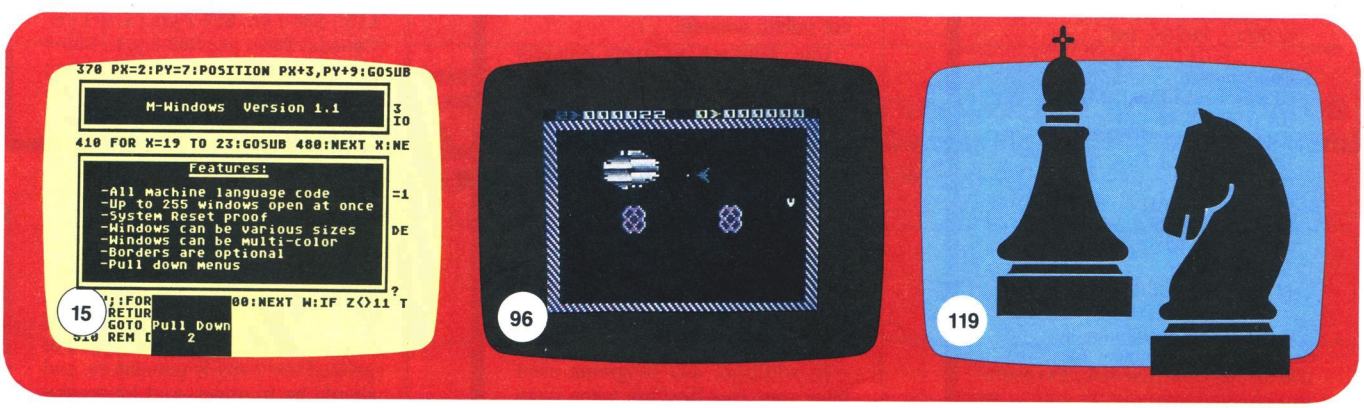
P:R: Connection . . . . . Matthew J.W. Ratcliff 43
(ICD Inc.)
This printer interface provides two RS232 ports.

SmarTEAM Modem . . . . Matthew J.W. Ratcliff 89
(Team Technology, Inc.)
A 300/1200-baud modem . . . a good alternative to the Hayes?

Panak strikes! . . . . . Steve Panak 116
Steve checks out the latest from Mastertronics, plus **The NeverEnding Story** (Datasoft), **Buzzword** (The Buzzword Game Co.) and **Trinity** (Infocom).

COLUMNS

Editorial . . . . . Diane Gaw 4
Reader comment 6
8-bit news 11
Database Delphi . . . . . Matthew J.W. Ratcliff 22
The End User . . . . . Arthur Leyenberger 26
Atari Users' Groups 36
M/L Editor . . . . . Clayton Walnum 42
Boot Camp . . . . . Karl E. Wiegers 90
Index to advertisers 132



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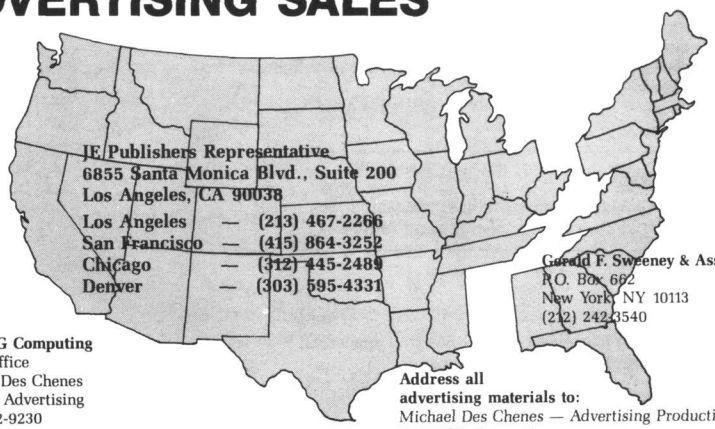

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Due, however, to many requests from Atari club libraries and bulletin board systems, our new policy allows club libraries or individually-run BBSs to make certain programs from **ANALOG Computing** available during the month printed on that issue's cover. For example, software from the July issue can be made available July 1.

This does not apply to programs which specifically state that they are *not* public domain and, thus, are not for public distribution.

In addition, any programs used must state that they are taken from **ANALOG Computing** magazine. For further information, contact **ANALOG Computing** at (617) 892-3488.

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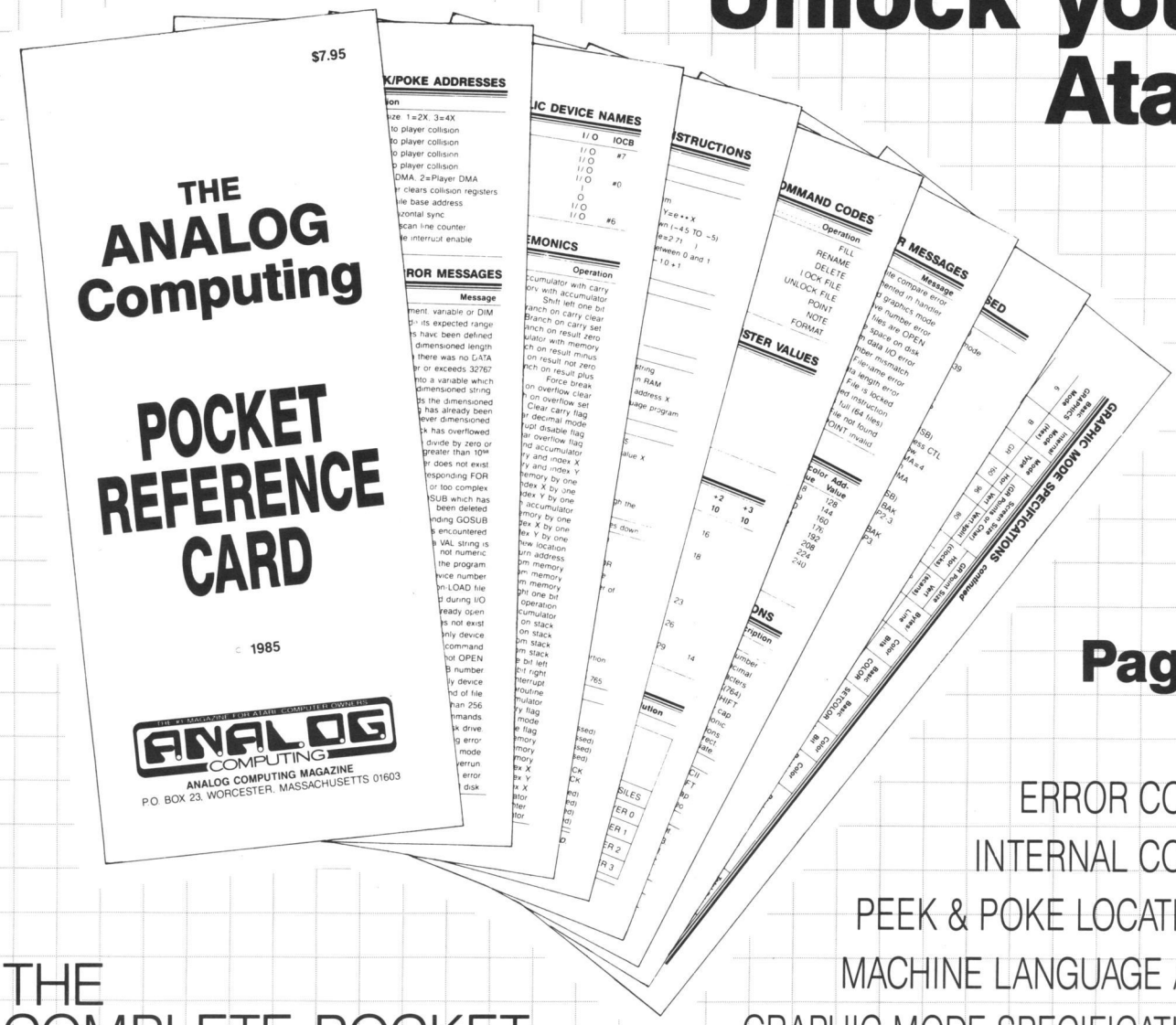

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Editorial

We hope that, after last issue, our 8-bit readers are saying, "How can they follow *that* act?" Because we can—for both the **ANALOG Computing** and **ST-Log** audiences.

This month, in each section, you'll find a **Status report** loaded with information about the future of Atari. In keeping with our format, the 8-bit and ST portions of the report are separate, but we suggest that you read both articles for a truly complete picture.

D.F. Scott has gathered facts, figures and future possibilities from some of the most knowledgeable personnel at Atari Corp. for these articles. We'll be publishing more of his work in this vein from time to time, as news becomes available. Our staff is excited about the **Status report** articles; we hope you'll find them interesting and enlightening, too.

ANALOGers Lee Pappas and Charles Bachand traveled to Los Angeles recently, to attend the ACENET-sponsored Atari Fair there. It was a terrific opportunity for them to talk with thousands of Atari users. The enthusiasm at the fair was impressive, since this (unlike CES or COMDEX) was an all-Atari show.

Charlie, our Senior Technical Editor, took on all the technical questions at **ANALOG Computing**'s booth. Lee reported a warm reception at the fair for both free copies of the magazine and the bonus gift we'd arranged.

Our thanks to ACENET for all their courtesy and assistance at the show—and for the chance to be included.

In an effort to demonstrate our ongoing support for user groups and Atari products, we'll be participating in as many of these shows as possible. The next we're planning on, which will be over by the time you read this, will have been in San Jose.

And, on Saturday, November 22, we'll be attending the PACE show at the Pittsburgh Greentree Marriott, from 8 a.m. to 4 p.m. For more details, contact PACE's John Baker, P.O. Box 13435, Pittsburgh, PA 15243.

Since the **ANALOG Computing** staff is small, we all wear several hats and our schedules are very full. We can't promise to attend every user show, but we'll do our best to be in touch with you. Just one question. . . how come there are no shows in places like Miami Beach, or Palm Springs, or Hawaii?

On another front, we're pleased to hear of the release of 3½-inch drives for the Atari 8-bits. This should be a boon to all traditional Atari owners—and give a boost to the 8-bit market, as well.

Though we don't have an exact date at this writing, you can look for the **Atari 8-bit Extra from ANALOG Computing** before Christmas. This isn't a compendium of previously published programs; it's a gathering of some of the best articles and software submitted to us that just wouldn't fit in these pages.

Believe it or not, that's a common problem. Every month, we have too much material for both the 8-bit and ST sections; and every month, we swear it won't happen again. We've tried some different approaches to get these articles and listings to our readers. The ST bonus disk program is one way; putting them up on our Atari Users' Group on Delphi is another; the **Extra** is a third.

We'd love to publish every worthwhile program we get—and we know people want to see **Reader Comment**, too. Unfortunately, there's a prescribed ratio for advertising to editorial copy pages. . . and we're already exceeding the limit (in the tiniest type readable), in an effort to give readers their money's worth of Atari material.

So, for you 8-bit users, the **Extra** is our special attempt to provide even more. We hope you'll use it—and enjoy it.

Diane L. Gaw
Managing Editor
ANALOG Computing

BOOK I + DISK: (The Original) Thoroughly explains the techniques used by advanced software pirates, and the copy protection methods used to stop them. It offers clear and understandable explanations sophisticated enough for software writers of any scale yet easy enough for a beginner just wanting to learn more about Atari® computers. A MUST READ FOR ALL ATARI® OWNERS.

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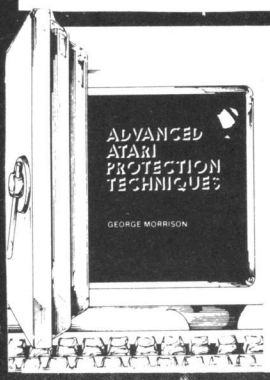

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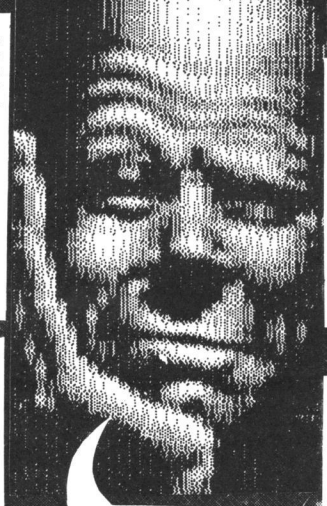

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Reader comment

Corrections for Magic Spell and Blast!

If you've been getting an ERROR 136 when trying to load issue 46's **Magic Spell**, run the following program with your **Magic Spell** disk in drive 1. Substitute the filename you gave **Magic Spell** for the FILENAME.EXT in Line 10. The program will create a new **Magic Spell** file, under the filename NEWPRG.OBJ. Note that, if you're using an XL or XE computer, you must first run the translator disk to use **Magic Spell**.

```
10 OPEN #1,4,0,"D:FILENAME
.EXT":OPEN #2,8,0,"D:NEWPR
G.OBJ"
20 FOR X=1 TO 4679:GET #1,
A:PUT #2,A:NEXT X:END
```

The above program will also be useful for those who've had trouble running **Blast!** from issue 44. Just change the number 4679 in Line 20 to 4092 and, of course, be sure to change the filenames in Line 10.

—Ed.

The separation issue: a bit from both sides.

No, no, no!. . . Don't separate **ST-Log** from your fine magazine as has been proposed.

As a long-time 800 owner and enthusiast, I fully intend to purchase an ST in the future, as soon as finances permit. But in the meantime, I can keep abreast of the news and articles about my "future" computer, while still getting the newest and best information about my present system. In fact, the thing that has "sold" me on the ST is the information I've learned about it through your pages and **ST-Log**. I imagine quite a few ST purchasers are former 8-bit owners who've been informed about the new line through your pages.

I feel you would be doing your readers and future 8-bit *and* 16-bit owners a disservice by publishing two periodicals, and creating a further division between 8-bit and 16-bit owners.

Sincerely,
David N. Osburn
Smyrna, DE

I feel compelled to comment on what appears to be the developing rift between the 8-bit and 16-bit subscribers—and on the Atari 520ST, in general.

First, I have watched the personal computer market closely for some years now, vowing that I too would be a computer enthusiast one day. My wife reminded me of one thing—that I had better plan my purchase carefully, and wait and see what further price drops occurred. Good thing; along came the 520ST, with the features, power, user-friendly interface and price which I found irresistible. I have had my ST for nine months now and plan to get many useful years of computing with it.

Now, about this controversy of 8-bit versus 16-bit. There are many owners of 8-bit machines out there, and I admire the pioneering spirit with which many bought their machines. However, the 16-bit machines are here to stay, and many are grumbling about what to do with their "old hardware". Use it, enjoy it and grow with it; that is the challenge. I prefer to use the ST, because of its mouse, windows and other user-friendly features.

I would prefer to see **ANALOG Computing** publish **ST-Log** as a separate magazine, because I want to learn more about the ST in general, as a novice. Also, this machine deserves more support in the way of type-in programs, articles, new products, etc.

In closing, I would like to say that **ANALOG Computing** is a fine magazine for Atari owners, one which has been at the forefront of the industry.

Sincerely,
Jeff Cotton
Jenks, OK

I am an 800 user, as well as a professional programmer, but I enjoy knowing what is happening in the **ST** world. I vote for keeping **ST-Log** and **ANALOG Computing** as one publication.

If you decide to separate the two after all, please keep a couple of pages of **ST** news in **ANALOG Computing**, and vice versa. That way, we old faithful Atari supporters will keep abreast of how the other half of "our" company is doing.

Eva Dano
El Monte, CA

By all means, take the **ST-Log** section out of **ANALOG Computing**, and make it into a separate magazine. However, keep a page or two about new ST developments in **ANALOG Computing**. I plan to get an ST in the future, and I would like to know about anything new that comes along.

Also, the ads for the new "TCS" say that you will get a $5.00 line-time credit. However, the information I received in the mail said I would get a $10.00 line-time credit. Why the unconformity?

Yours truly,
James H. Ellwanger
Tampa, FL

The $10.00 credit applies for previous TCS subscribers, while the $5.00 credit is for magazine subscribers. —*Ed.*

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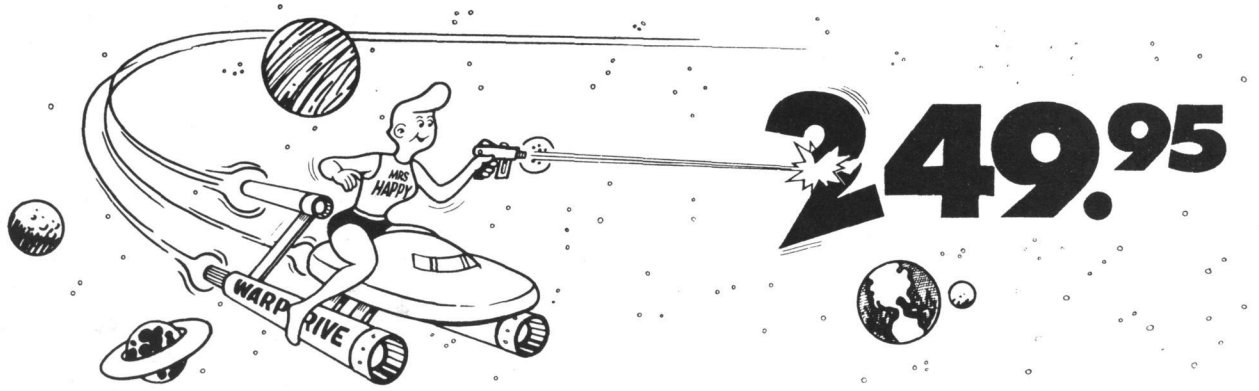

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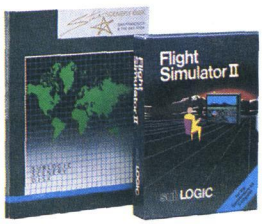


CIRCLE #102 ON READER SERVICE CARD

A little blatant praise. . .your issue 45 was the most information-packed I've seen. I must congratulate you on an excellent report of the West Coast Computer Faire, though I can't decide whether it was **ANALOG Computing**'s (Matthew J.W. Ratcliff's) great job of reporting, or just the great stuff you were given to report, that made it so good. I'm really looking forward to your Summer CES report. Also, thanks for the second **Guide to ST Software** in issue 44.

About **ST-Log** : I think you should keep **ANALOG Computing** and **ST-Log** together. One of the main reasons I take **ANALOG Computing** is to keep up with *all* Atari news. If you make **ST-Log** a separate magazine, I'll no longer have ST news or ST product reviews, and I doubt if I could handle a double subscription. And what about CES and COMDEX reports? There is certainly an increase in ST coverage in these reports (and in their respective shows). If **ANALOG Computing** goes it alone, will I open my magazine to see a (gulp!) half-page report on CES, a page on COMDEX? I say the ST coverage is well worth a price increase, albeit a small one, please.

Thanks for the Delphi information in issue 45 (not to mention the actual TCS changeover). Keep up the great work.

Yours truly,
Donald Lancon, Jr.
(DCLJR on Delphi)

First, I would like to comment on the 8- versus 16-bit *controversy*. I bought my first computer in September 1981. The system consisted of the Atari 800 (16K), a 410 program recorder, **Star Raiders** and a pair of joysticks. I paid $930.00 (at discount) for this system. A month later, I purchased an 810 (88K) disk drive for $470.00 (also discounted).

Needless to say, when I purchased my second computer, it, also, was an Atari system. This new system consisted of: 520 ST (1040K with upgrade), SC1224 RGB color monitor, SF314 (760K) disk drive, mouse and assorted software. This cost $1080.00 in March 1986.

I guess I should be upset that this new level of sophistication, power and technology are now available. . .I'm not! I most certainly should regret (and perhaps be a bit displeased) that today's 8-bit Atari is not only much less expensive, but a more powerful machine. . .I don't! The point is, I have both machines side-by-side and, yes, I still use the old reliable 800.

There should be no controversy. Improvement and progress should be welcomed. When progress stops, there will not only be a controversy; it will be *the end*. I'm an Atari enthusiast and would like to see an end to this rift.

I would now like to comment on **ANALOG Computing** and **ST-Log**, i.e. your editorial in issue 45. I, for one, enjoyed reading about the ST computers (in **ANALOG Computing**) long before I purchased the system; you kept me informed of the latest developments. On the other hand, if you increase the size of the ST section, costs and subscription rates will go up. This will penalize those readers not interested in the ST line.

Two separate magazines seems to be the fair solution, those interested in both computers may receive both publications. Those interested in one or the other (or neither) may do as they wish. Perhaps you could have an ST news section in **ANALOG Computing** and a 8-bit news section in **ST-Log**, to satisfy those who are using one system, yet are interested in brief news about the other. Hopefully, this can be done without increasing costs, so that one group is not subsidizing the other.

Sincerely,
Rick Nichols
Torrance, CA

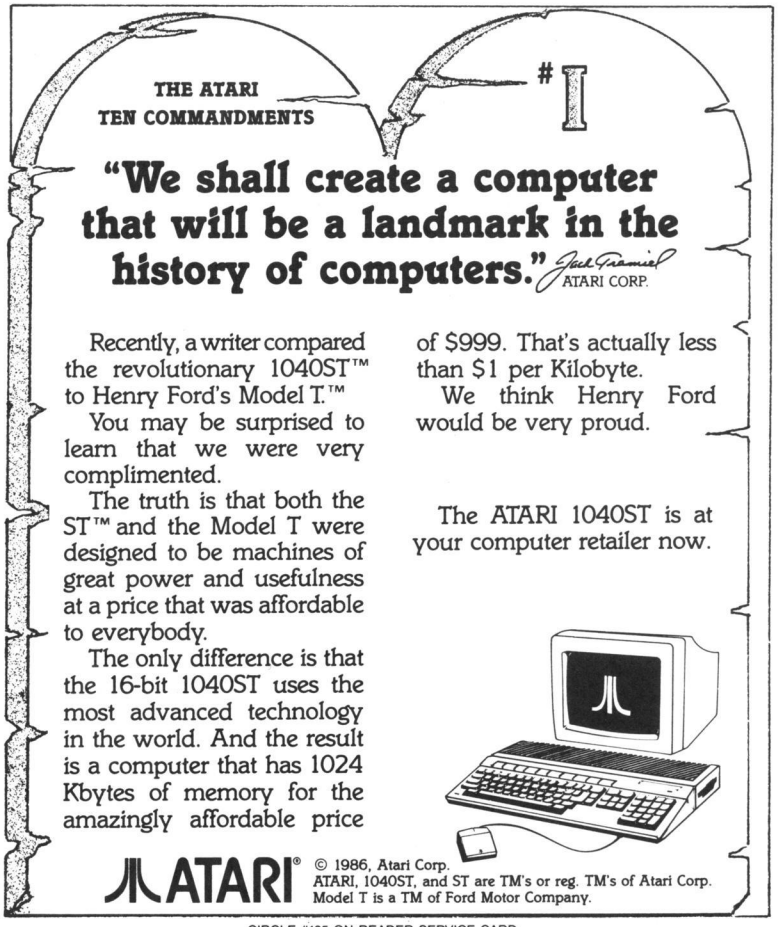
The disk bonus: plus or minus?

I want to comment on something I think is a really bad start. In issue 45, you had an article for ST disk subscribers only. Yet the magazine is not "disk-bound" (that is, either you buy both or none, like the upcoming *COMPUTE! ST*), and the disk is supplied as a supplementary aid for those who don't want to type. It is supposed to have only programs, listings of which are printed in the magazine. Any other choice treats all the rest of us as second-rate subscribers.

A clear explanation of the policy to be followed and a publication of these articles would be the best solution.

Sincerely yours,
E.D. Varkaris
Troy, NY

The disk-only magazine articles are not intended to make magazine subscribers feel second rate, or even to force them to purchase the disk. We're attempting to make available the best ST software we can get our hands on. Frequently, the listings for these programs are much too large to make magazine publication feasible. If we didn't go to a disk-only format on these items, we would be unable to publish them at all. We don't find that an acceptable alternative.



CIRCLE #105 ON READER SERVICE CARD

Furthermore, you don't need a disk subscription to get these programs. They're available in ***ANALOG Computing****'s Atari Users' Group on Delphi.*

We're trying to strike a happy medium, and not go to the total disk-only system other magazines have adopted. When possible, program listings will be printed in the magazine. Some articles will be tutorial in nature, including important routines within the article, while the complete program listing resides on disk. This method assures that our magazine will remain valuable to all readers (and not sport an expensive $14.95 price tag). —Ed.

Troll War fix.

There is an error in the **Troll War** game program (issue 45). The program will not survive SYSTEM RESET. The boot header initialization address is 27F9 in Line 230. This address originally contains an RTS instruction. After the program runs, it clears that address. The RTS is gone! Line 230 should read:

DATA 0, 23, 210, 39, **102, 43,** 169, 0, etc.

Yours truly,
David E. Wolff
San Jose, CA

Main Street.

In our issue 46 June CES coverage, Matthew Ratcliff mentioned Main Street Publishing as a company that markets classic Atari software very cheaply—but we didn't then have an address. Here it is: Main Street Publishing, 611 W. Travelers Trail, Burnsville, MN 55337 — (800) 334-3645; in Minnesota, (612) 894-7950. —Ed.

M/L keypad.

I recently typed in Clayton Walnum's **BASIC Editor** (issue 43), and I was working on some changes when **BASIC Editor II** (issue 45) came out. It is a much superior program and works very well.

I was interested in **Magic Spell** (issue 46), so I typed in **M/L Editor**. This also works well, but I felt a minor change was needed. Instead of being able to enter numbers with only the "top row" (the normal keyboard layout), I felt it would be easier to type in via a keypad.

In issue 14, Randal C. Gibson's **Hexpad** used a machine language routine to change several characters, so that the right half of the keyboard formed a keypad. I used his routine, with a few modifications, to form a similar keypad.

The M/L subroutine changes the letters *JKL* to *123*, *UIO* to *456*. The numbers *789* are already in position. Other changes: *M* becomes *0*, as does the SPACE BAR, and the comma is changed to RETURN. I changed the latter because, the way the program is set up, a comma is never typed; all entries are separated by RETURN. This allows for less movement of the right hand.

The program will convert only the keys listed, but as originally written, it would only accept numbers or RETURN. All other keys are unchanged, so either the "top row" keys or the new "keypad" can be used to enter the code.

```
25 FOR X=1536 TO 1579:READ
 A:POKE X,A:NEXT X
165 POKE 702,64:REM PUT KE
YBOARD IN UPPERCASE
325 A=USR(1536,A)
600 DATA 162,8,104,104,104
,221,26,6,240,10,202,16,24
8,133,212,169,0,133,213,96
,189,35,6,76,13,6
610 DATA 32,77,44,74,75,76
,85,73,79,48,48,155,49,50,
51,52,53,54
```

Thank you,
Trent Tadsen, M.D.
LaGrange, GA

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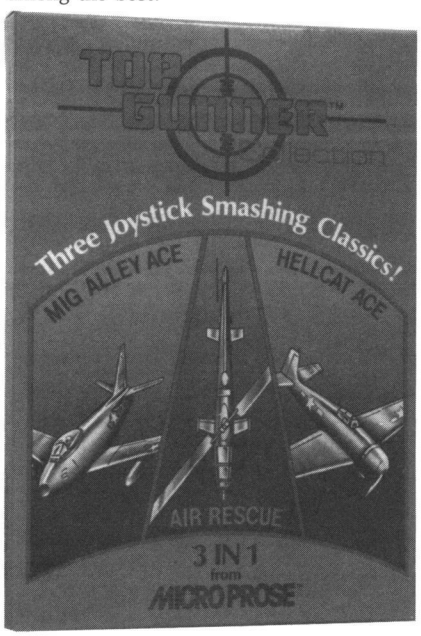
CIRCLE #106 ON READER SERVICE CARD

8-bit news!

TOP GUNNER

Now you can have a crack at downing enemy fighters, in one of the three games in this package. Each of these games was previously released individually, under the titles **Hellcat Ace**, **MiG Alley Ace** and **Air Rescue**. (You may recall, in issue 20, the **ANALOG Computing** staff chose **MiG Alley Ace** as one of our all-time favorites.)

A double-sided disk, complete with a 30-page manual, comprises the set—at $24.95, that's less than each program originally sold for alone. While none of the games has truly outstanding graphics, their playability is top-notch, and the multi-player capability is among the best.



Hellcat Ace is set over the South Pacific and recreates fourteen US-Japanese battles. From your "cockpit," you hunt down aircraft and attempt to blow them out of the sky. **Air Rescue** is an arcade-type game, on the idea of **Defender/Scramble**. **MiG Alley Ace** has a split screen, to give your view out of the windshield *and* your opponent's view. Your enemy can be another player or the computer. Each tracks the enemy, the goal being to knock the other plane out of the sky.

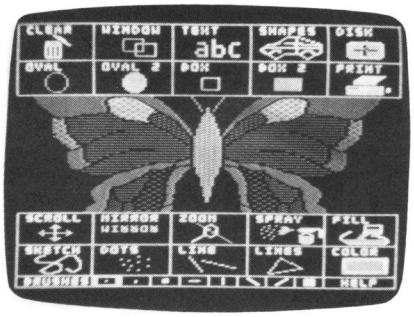
At $24.95, Microprose Software, 120 Lakefront Drive, Hunt Valley, MD 21030 — (301) 667-1151. CIRCLE #101 ON READER SERVICE CARD

BLAZING PADDLES

This all-in-one illustrating program draws, paints and prints your custom pictures. Or you may choose from a variety of pre-drawn shapes and text fonts.

Blazing Paddles works with a myriad of input devices, including light pens, **Koala Pad**, joystick and trackball. Printers supported include Okimate 20, Epson, Gemini 10X and 15X, and Panasonic.

The program allows many drawing functions, among them free-hand sketch mode, individual pixels/dots, circles and ellipses, squares and rectangular boxes, text, cut and paste, predrawn shapes, zoom, spray, and fill. Pictures can be saved and loaded to disk, or graphics hard-copy can be achieved, using one of the printers listed above.



The cost is $34.95, from Baudville, 1001 Medical Park Drive, SE, Grand Rapids, MI 49509 — (616) 957-3036.

CIRCLE #189 ON READER SERVICE CARD

OTHER NEWS

Intellicreations has released a new graphics text adventure game, **Gunslinger**. In it, you take on the role of Kip Starr, a retired Texas Ranger. But events have caught up with him—it's time for action!

Poor Kip must journey through perilous country, including a ghost town and a deserted mine, then cope with ambushes and hostile Indians. This game features a graphics window and a separate text display.

Retail is $29.95. Intellicreations/Datasoft, Inc., 19808 Nordhoff Place, Chatsworth, CA 91311 — (818) 886-5922.

CIRCLE #190 ON READER SERVICE CARD

■ ■ ■

XLent Software is offering **Miniature Golf**, which allows you to play any number of holes per game, design your own scenes and set up stationary or moving boundaries.

Up to eight people can play, and you can store up to sixty holes per disk. Geometry, physics, friction and gravity are all simulated.

The price is $29.95, from XLent Software, P.O. Box 5228, Springfield, VA 22150 — (703) 644-8881.

CIRCLE #170 ON READER SERVICE CARD

■ ■ ■

Six Fork's **Assembler and Linker** lets you enter in source code using a word processor (of your choice), rather than a unique editor.

Moreover, instead of having a single large source file, everything is divided into small subroutines. The linker gives the option of having a "library" of subroutines you can use in any of your programs.

Priced at $39.00. For further information, contact Six Forks Software, 11009 Harness Circle, Raleigh, NC 27614 — (919) 847-2740.

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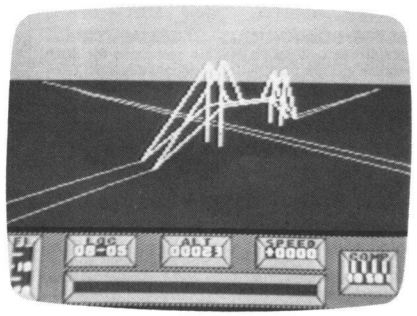

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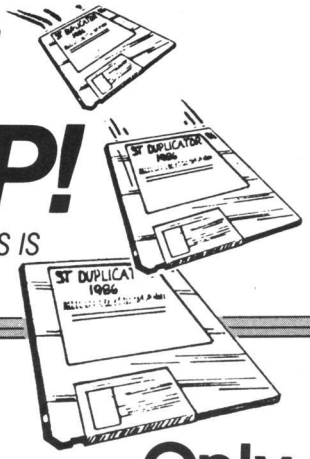

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Status report
8-BIT SECTION

Atari: This is the future.

by D.F. Scott

The material here is part of a complete overview of Atari Corp.'s plans and possibilities. Among the sources drawn from: Michael Katz, Executive Vice-President in charge of Entertainment Electronics; Leonard Tramiel, Vice-President in charge of Software; Shiraz Shivji, chief developer of the ST "blitter" chip; Jim Tittsler, developer of the ST's IBM PC-compatibility unit; and other sources who wish to remain anonymous.

This portion of the report deals with the future of Atari from the 8-bit point of view. For an integrated, comprehensive picture, we suggest that readers refer to the ST section of the article, found on page 51ST. The two sections form an informative, insightful image of what we, the users, can expect from Atari.

Entertainment Electronics.

Atari's roots are in game machines, and that's nothing to be ashamed of. The creative genius who invents or programs a computer is the same genius who toys around with it. Still, the 8-bit Ataris have always had to be proven and fought for. It's as if the machines themselves were a *cause*, like unionization or the abolition of apartheid.

The storm is over now, and the war-torn Atari 8-bits—and even the home video games—are still with us. Within the fast-moving vehicle that is now Atari Corp., there are those who say 8-bits and video games have taken a definite, permanent backseat to the STs and TTs.

Michael Katz doesn't want the backseat. Formerly of Mattel, Coleco and Epyx, the current chief of the Entertainment Electronics division firmly claims his copilotship of Atari, and his presence is certainly felt. He's taken control of the 8-bit product line altogether, renewing the 65XE and the 7800 game system. In terms of marketing, he's turning the Tramiel philosophy completely around. If you live in Philadelphia, you may already have seen the final results of that turn-around: TV commercials.

If you're wondering how the Jack Tramiel philosophy of "newspaper ads only" could have been so directly contradicted, read the words of Katz himself: "Our emphasis is to get better distribution on the 8-bit computers. In other words, get major accounts—whether they're specialty dealers or mass-merchants or department stores carrying the 8-bit line. . . Advertising, which we're thinking about doing on TV, is in the right direction. We just have to get those retailers committed to carrying software and carrying the product."

"We've already produced two new commercials for the video games, that are running right now in the Philadelphia test market." Each TV ad would center on a specific product, Katz told us, not a portion or the entirety of the Atari line. Still, we asked him, isn't that going against what your boss used to say, that newspaper ads are the cheapest way to reach the most people? "That's true for the ST," Katz responded, "which is not a broad-market product right now. But it's *not* true of the 8-bit computers, which have a mass-market appeal."

So, if you're one of those who marched bravely down the aisles of a computer store chanting, "The XE's not a game machine," lay down your arms. Atari itself is about to tell you that it *is*. Public Relations Director Neil Harris broke the news officially, when his BBS news file stated the new 65XE promotion would be "as an advanced game machine." Michael Katz explains: "For ads, it's positioned two ways: For the game aficionado, it's the ultimate video game system that's also a computer; for the beginning computer buff, it's the best beginning computer system, because it's low-priced, it's got 64K and it's expandable. So it's the best of both worlds."

Leonard Tramiel has no qualms with this promotional strategy, but doesn't consider it a permanent one: "You can market the computer as an advanced game machine. . . as an introductory computer, [or] as a word-processing bundle. That *particular* promotion is aimed in that direction."

Does this make the 130XE a "super-ultra-advanced game machine" or a word processor—this year? Tramiel reiterates, "That changes from promotion to promotion. It's just a question of how it's being marketed at a particular time."

"The 130, at the moment, is being marketed bundled with a printer." Will the promotion undermine the status of the 8-bit line? Answers Tramiel, "No, not in any way. That's how most people use them, anyway."

Michael Katz, on the same topic: "It's just been in the last six months that the game market has started to come back strong. So anyone's interest, specifically in

game-playing machines, has been fueled by what we're seeing in the marketplace in the last few months. There's definitely a market for video game systems, and there's definitely a market for home computers. There's no reason why there can't be a lot of business in both segments."

Katz feels there'd be a lot more business in his segment if salesmen would just take the 8-bits and video games seriously. "One of the problems," he points out, "is that software distributors are not supporting the 8-bit software as much as they could be. Third-party software companies don't have a constant availability of 8-bit software, even though they've got it in their catalogs. So we're working to try to correct those problems, [such as] consumers and retailers not being able to get enough 8-bit software from either distributors or third-party people."

He doesn't stop there. Katz also wants a piece of the ST's action: "We've thought about the capabilities of the ST as a game-playing possibility. . . It's very good with graphics and sound—and those are important elements in games. We're looking at the potential of the ST as playing some kind of a role, possibly, in a new game-playing machine."

It appears that even if Atari isn't "backburnering" the 8-bit projects, its distributors and retailers are. They feel the ST is generating the energy. A peculiar double-standard is revealed here: software publishers say they don't want to produce products where a potential customer base hasn't yet been established. But, where such a base exists, it's dismissed as belonging to the older generation of computers. If a company combines both of these operating methodologies, it will sell nothing—and will be counted among the fatalities of the industrial "shakeout."

The XE exists now. It cannot be ignored. In the fields of telecommunications, number-crunching, record-keeping and game-playing, the 8-bits have their place. Because a company chooses to hitch itself to the ST rocketship doesn't mean it has to abandon more solid ground of the 8-bits. Older generation, yes, but old never meant dead. If a product hangs around the market a long while, it's usually because that product is strong, substantial and solid.

If products die out in their infancy, it's because they can't find that solid ground—remember the Atari Graduate? The 5200? The 1200XL? All these Atari products failed in their attempt to take an existing solid product and make it into something it wasn't. Despite cosmetic changes, the Atari 8-bits have survived unblemished. We mustn't forget that, if not for the revenue generated by the 8-bit line, games and computers, the ST would be dead in the water today—along with its manufacturer.

How will Entertainment Electronics generate the money to fuel development? In the video game department, titles from the 8-bits will be translated over to the 7800, using a special enhancement cartridge Michael Katz tells us will bear a 1-megabit internal storage capacity. These will *not* be former Atari titles, but games from (among others) Electronic Arts, Broderbund and Katz's former domain, Epyx. Doug Neubauer, who wrote the original **Star Raiders**, is reportedly being employed to enhance the game machines' ongoing library.

In an even more surprising development, Katz has been leading Atari into markets broader than those governed by the microchip alone. As Katz says, "Entertainment Electronics is pretty broad. We still have a definite interest in getting into products other than video games, but it probably will not happen until 1987. . . We hope to have some new products at least by Christmastime."

As to what sort of product(s) Katz refers to, we can only speculate—possibly TVs, VCRs, CDs. That's still a company secret. But if Katz's timetable seriously calls for a December 1987 release date for new products, Atari must be pretty far along in situating itself to market broadly-defined home electronics. We can assume whatever Atari's planning to produce is something close to its home territory. It produces monitors now; it may as well produce TVs. Perhaps they can be packaged with the 8-bits for a discount. Home robots, though, are definitely out—it seems Atari doesn't want to get into the automated housecleaning industry.

Conclusion.

Nearly two years after Tramiel and sons assumed the debts of the faltering Atari from Warner Communications, the company is no longer ashamed to be producing game machines—as long as it also has a computer product that proves its creative genius applies to reality—not just fantasy. We're beginning to realize it wasn't *games* that nearly sank Atari; it was a drastically colossal management contradicting itself at every turn, skilled perhaps in marketing tobacco and soda pop, but not computers.

We've come so far in two years, haven't we? STs can be bought for a fraction of what we may have spent on an XLD, so you'd think the only way for Atari to go from here is further up. It isn't that easy. Atari's developers may have served us the future on a silver platter, but does that mean the company's banquet table is open to anyone and everyone? As Michael Katz pointed out, the ST isn't broad-market material; but some will say it isn't vertical-market material either—so just what is it? After Atari decides just what is what, can this same company still sell you **Pac-Man** and **Star Raiders**? On *TV*? On, perhaps, an Atari-*brand* TV?

We'll be checking back with Atari from time to time to see how the company chooses to address these issues.

D.F. Scott is an artist, writer, educator and programmer living in Oklahoma City. He is currently engaged in the study of quantum physics, computing and other ways in which elementary particles interact with each other. Otherwise, he fills infinite pieces of paper.

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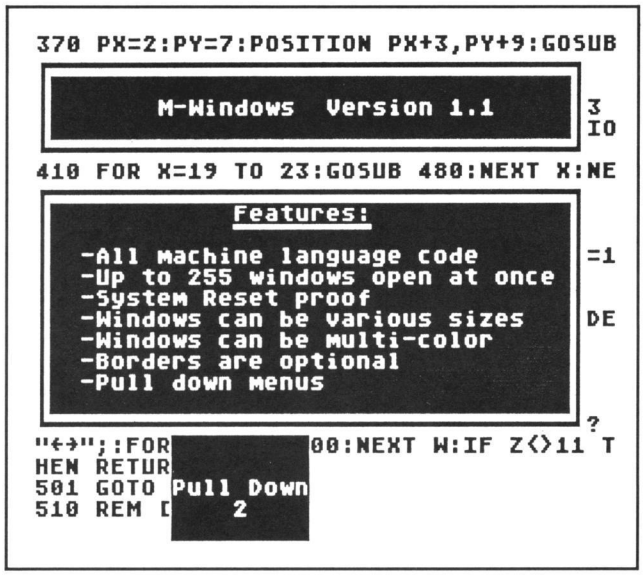

M-Windows

Now, your 8-bit Atari can have all the windows you'll ever need.

by Kevin Ravenhill

How many 8-bit users feel neglected because windows pop up (pun intended) everywhere but on *their* machines? If you're one of these people, we've got the solution for you. How would you like to be able to open a window with your choice of size, screen position, color and border? Sounds good, eh? What if you could have up to 255 of these windows open simultaneously? If these features are appealing, **M-Windows** is for you.

Listing 1 is the BASIC data used to create your copy of **M-Windows**. Please refer to the **M/L Editor** on page 42, for typing instructions. You should name the resultant file AUTORUN.SYS.

Listings 2 and 3 are demos that show **M-Windows** in use. You should type these listings using the BASIC Editor II (issue 47). When you run the programs, you must have booted your system with the disk containing the AUTORUN.SYS file created from Listing 1.

Listing 4 is the assembly language source code for **M-Windows**. You don't have type this listing in. It's included for our readers who are interested in assembly language programming.

How it works.

M-Windows is an AUTORUN.SYS file that installs itself immediately after DOS, and is transparent to the user. It's also SYSTEM-RESET-proof. To open a window, six parameters are required. The first is the address of the open window routine—it's always *7459*.

The next two specify the top left corner of the window in X/Y-coordinate format. The X-position values may range from *0* to *39*, and the Y-position values from *0* to *23*.

The fourth and fifth parameters specify the size of the window. The fourth contains the width, which may be from 1 to 40 characters. The fifth specifies the length, from 1 to 24 characters.

The last parameter is a border "flag." If a value of *0* is passed, no border is drawn. A value between *1* and *127* draws a border in normal video. A value above *127* draws a border in reverse video. If you tried the following: *X=USR(7459,0,0,10,5,0)*, you'd open a 10x5-character window without a border, at the top left-hand corner of the screen.

Closing a window is even easier. Only one parameter is passed, the address of the routine close the window. *X=USR(7826)* would close the *last* window opened. If you try to close a window when there is none open, no harm is done.

Using **M-Windows** is simple, but there are a few things to keep in mind. If you open a window that's smaller than 3x3 characters, you should do so without a border. Otherwise, strange things occur. If you go to DOS, **M-Windows** will be wiped out, unless you use a MEM.SAV file. When you open or close a window, it's advisable to position the cursor away from the projected area of the window, like this:

```
POSITION 0,0:? " ";:X=USR(7459,2,10,15
,5,0)
```

If the cursor is on the window when it's being closed,

there's a chance of a character not being replaced. If your cursor is nowhere near the window when it's being opened or closed, don't worry about it. POKEing 8045 with a *0* will tell **M-Windows** that there are no windows currently open.

It's a good idea to zero the window counter when you run a program, just in case any windows remain open from previous programs. Normally, reverse spaces are used to draw window backgrounds. This fill character is user-definable. POKEing a value into 7625 will change the character used to draw the window background. Experiment; try redefined character sets.

M-Windows calculates the address of the top left corner from the X- and Y-coordinates you supply. The characters hidden behind the window are stored on a stack that starts at the top of memory and grows down, toward your BASIC program. In addition to the characters, **M-Windows** pushes the parameters onto the stack. When you close a window, the process is reversed. First, the parameters are pulled from the stack. Then, the characters are stored on the screen, restoring its original state.

When a window is opened or closed, the value returned is the address of the bottom of the stack. You should watch this value, to prevent it from colliding with your BASIC program. The top of your BASIC program is stored in locations 14 and 15, like this:

```
TOPBASIC=PEEK(14)+256*PEEK(15)
```

Before you open a window, it's wise to check that the stack value will not go below the top of your program.

M-Windows gives your programs a professional look, without making you buy an ST, or numb your brain learning fancy routines.

Does your computer do windows? Mine does!

Kevin Ravenhill is a courier for a clinical laboratory. Since this is a mind-numbing job, his Atari 800 provides a source of mental stimulation. He's enjoyed writing utilities in machine language and BASIC over the past four years.

The two-letter checksum code preceding the line numbers here is *not* a part of the BASIC program. For further information, see the *BASIC Editor II* in issue 47.

Listing 1.
BASIC listing.

```
1000 DATA 255,255,0,29,111,31,165,12,1
141,14,29,165,13,141,15,29,413
1010 DATA 76,16,29,32,255,255,169,0,14
1,231,2,169,32,141,232,2,6852
1020 DATA 169,13,133,12,169,29,133,13,
96,104,104,104,141,100,31,104,3374
1030 DATA 104,141,99,31,104,104,141,10
1,31,141,103,31,104,104,141,102,4525
1040 DATA 31,141,104,31,104,104,141,98
,31,41,128,141,106,31,173,99,4484
1050 DATA 31,133,203,169,0,133,204,24,
6,203,38,204,24,6,203,38,4049
1060 DATA 204,24,6,203,38,204,165,203,
141,96,31,165,204,141,97,31,7462
1070 DATA 24,6,203,38,204,24,6,203,38,
204,24,165,203,109,96,31,5424
1080 DATA 133,203,165,204,109,97,31,13
3,204,24,173,100,31,101,203,133,7507
1090 DATA 203,165,204,105,0,133,204,24
,165,203,101,88,133,203,141,107,9153
1100 DATA 31,165,204,101,89,133,204,14
1,108,31,56,169,40,237,101,31,6051
1110 DATA 141,105,31,173,109,31,208,13
,173,229,2,133,205,173,230,2,8571
1120 DATA 133,206,32,51,31,238,109,31,
160,0,177,203,145,205,169,128,9720
1130 DATA 145,203,32,9,31,32,51,31,206
,103,31,173,103,31,208,232,6671
1140 DATA 206,104,31,173,104,31,240,23
,24,165,203,109,105,31,133,203,7358
1150 DATA 165,204,105,0,133,204,173,10
1,31,141,103,31,76,194,29,32,3791
1160 DATA 37,31,165,203,145,205,32,51,
31,165,204,145,205,32,51,31,5440
1170 DATA 173,105,31,145,205,32,51,31,
173,102,31,145,205,32,51,31,3080
1180 DATA 173,101,31,145,205,32,51,31,
173,98,31,208,3,76,0,31,1023
1190 DATA 174,101,31,202,202,142,110,3
1,172,102,31,136,136,140,111,31,5777
1200 DATA 173,107,31,133,203,173,108,3
1,133,204,169,81,13,106,31,160,6015
1210 DATA 0,145,203,32,65,31,172,101,3
1,136,169,69,13,106,31,145,3524
1220 DATA 203,32,82,31,169,124,13,106,
31,160,0,145,203,172,101,31,5062
1230 DATA 136,145,203,32,82,31,206,111
,31,173,111,31,208,230,169,90,8820
1240 DATA 13,106,31,160,0,145,203,32,6
5,31,169,67,13,106,31,172,3173
1250 DATA 101,31,136,145,203,76,0,31,1
04,173,109,31,208,3,76,0,2243
1260 DATA 31,32,23,31,206,109,31,160,0
,177,205,141,101,31,141,103,5956
1270 DATA 31,32,23,31,177,205,141,102,
31,141,104,31,32,23,31,177,2716
1280 DATA 205,141,105,31,32,23,31,177,
205,133,204,32,23,31,177,205,6608
1290 DATA 133,203,32,23,31,177,205,145
,203,32,23,31,32,37,31,206,3296
1300 DATA 103,31,173,103,31,208,238,17
3,101,31,141,103,31,56,165,203,7765
1310 DATA 237,105,31,133,203,165,204,2
33,0,133,204,206,104,31,173,104,9770
1320 DATA 31,208,210,32,51,31,165,205,
133,212,165,206,133,213,96,24,9900
1330 DATA 165,203,105,1,133,203,165,20
4,105,0,133,204,96,24,165,205,9085
1340 DATA 105,1,133,205,165,206,105,0,
133,206,96,56,165,203,233,1,8945
1350 DATA 133,203,165,204,233,0,133,20
4,96,56,165,205,233,1,133,205,945
1360 DATA 165,206,233,0,133,206,96,160
,1,174,110,31,169,82,13,106,5056
1370 DATA 31,145,203,200,202,208,250,9
6,24,165,203,105,40,133,203,165,1302
1380 DATA 204,105,0,133,204,96,0,0,0,0
,0,0,0,0,0,0,3922
1390 DATA 0,0,0,0,0,0,255,255,224,2,22
7,2,0,29,34,29,1152
```

Listing 2.
BASIC listing

```
WV 100 REM *** M-Windows v1.1 Demo 1 ***
FQ 110 WOPEN=7459:WCLOSE=7826
BF 120 FILL=7625:NUMBER=8045
GS 130 POKE NUMBER,0:POKE FILL,128
SR 140 DIM TEXT$(38):POKE 712,PEEK(710):P
   OKE 752,1:? "R";:LIST 310,510
NF 150 REM [[TITLE]]
```

```
IW 160 RESTORE :PX=2:PY=1:SX=36:SY=5:BORD
   ER=1:GOSUB 460:POSITION PX+8,PY+2:GOSU
   B 500
TO 170 PX=2:PY=7:SX=36:SY=12:BORDER=1:GOS
   UB 460:POSITION PX+13,PY+1:GOSUB 500
CF 180 REM [[FEATURES]]
FW 190 FOR X=3 TO 5:POSITION PX+3,PY+X:GO
   SUB 500:NEXT X
AL 200 REM [[VARIOUS SIZES]]
CY 210 POSITION PX+3,PY+6:GOSUB 500
NU 220 FOR X=3 TO 7:PX=X-2:PY=10+X:SX=X:S
   Y=X:BORDER=128:GOSUB 460:PX=42-X-X:GOS
   UB 460:NEXT X
MB 230 FOR X=1 TO 400:NEXT X:FOR X=1 TO 1
   0:GOSUB 480:NEXT X
YA 240 REM [[MULTI COLOR]]
ZF 250 PX=2:PY=7:POSITION PX+3,PY+7:GOSUB
    500
HG 260 POKE FILL,0:PX=6:PY=16:SX=9:SY=5:B
   ORDER=1:GOSUB 460
ZJ 270 POSITION PX+2,PY+2:GOSUB 500
FR 280 POKE FILL,128:PX=25:BORDER=128:GOS
   UB 460
GC 290 POSITION PX+2,PY+2:GOSUB 500:FOR X
   =1 TO 400:NEXT X:GOSUB 480:GOSUB 480
RU 300 REM [[BORDERS]]
AE 310 PX=2:PY=7:POSITION PX+3,PY+8:GOSUB
    500
KX 320 PX=2:PY=20:SX=36:SY=3:BORDER=0:GOS
   UB 460:POSITION PX+5,PY+1:GOSUB 500
UE 330 BORDER=1:GOSUB 460:POSITION PX+5,P
   Y+1:GOSUB 500
KS 340 BORDER=128:GOSUB 460:POSITION PX+5
   ,PY+1:GOSUB 500
ZL 350 FOR X=1 TO 3:GOSUB 480:FOR Y=1 TO
   100:NEXT Y:NEXT X
NQ 360 REM [[PULL DOWN MENU]]
BW 370 PX=2:PY=7:POSITION PX+3,PY+9:GOSUB
    500
QJ 380 FOR Z=2 TO 36 STEP 9
RB 390 SX=9:SY=1:BORDER=0:FOR Y=19 TO 23
YI 400 PX=Z:PY=Y:GOSUB 460:NEXT Y:POSITIO
   N PX,21:GOSUB 500
IN 410 FOR X=19 TO 23:GOSUB 480:NEXT X:NE
   XT Z
WI 420 REM [[CLOSE ALL WINDOWS]]
KC 430 FOR X=1 TO 400:NEXT X
DP 440 FOR Y=1 TO 2:X=USR(WCLOSE):FOR X=1
    TO 200:NEXT X:NEXT Y:GOTO 160
BP 450 REM [[OPEN WINDOW]]
QY 460 WINDOW=USR(WOPEN,PX,PY,SX,SY,BORDE
   R):RETURN
QW 470 REM [[CLOSE WINDOW]]
HT 480 WINDOW=USR(WCLOSE):RETURN
DL 490 REM [[DISPLAY TEXT$ & WAIT]]
HC 500 READ TEXT$:? TEXT$:POSITION 0,0:?
   "↔";:FOR W=1 TO 300:NEXT W:RETURN
WO 510 REM [[TEXT]]
NF 520 DATA M-Windows  Version 1.1,Featur
   es:↓↔↔↔
```

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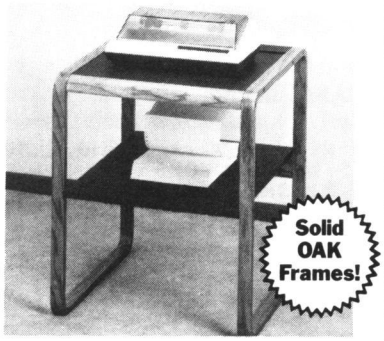

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M-Windows *continued*

Listing 4.
Assembly listing.

```
;### M-WINDOWS v1.1 ###
;
          *=  $1D00
;
DOSINI    =   $0C
SAVMSC    =   $58
WINDOW    =   $CB
STACK     =   $CD
FRO       =   $D4
MEMTOP    =   $02E5
MEMLO     =   $02E7
;
          LDA DOSINI  ;
          STA RESET+1 ;
          LDA DOSINI+1 ;
          STA RESET+2 ;
          JMP INIT    ;
;
RESET
          JSR $FFFF   ;
;
INIT
          LDA #$00    ;SET LOMEM AT
          STA MEMLO   ;$2000
          LDA #$20    ;
          STA MEMLO+1 ;
          LDA #RESET&255 ;SET SYSTEM
          STA DOSINI  ;RESET VECTOR
          LDA #RESET/256 ;TO POINT TO OUR
          STA DOSINI+1 ;RESET ROUTINE
          RTS         ;
;
;##########
;OPEN WINDOW
;##########
;
          PLA         ;POP # OF ARG
          PLA         ;POP HI  X-POS
          PLA         ;POP LO X-POS
          STA X.POS   ;
          PLA         ;POP HI Y-POS
          PLA         ;POP LO Y-POS
          STA Y.POS   ;
          PLA         ;POP HI X SIZE
          PLA         ;POP LO X SIZE
          STA X.SIZE  ;
          STA X.COUNTER ;
          PLA         ;POP HI Y SIZE
          PLA         ;POP LO Y SIZE
          STA Y.SIZE  ;
          STA Y.COUNTER ;
          PLA         ;POP HI BORDER
          PLA         ;POP LO BORDER
          STA BFLAG   ;
          AND #$80    ;MASK OFF THEN
          STA VIDEO   ;HI BIT
;
;
CALCULATE.WINDOW.ADDRESS
          LDA Y.POS   ;MULT Y-POS * 40
          STA WINDOW  ;
          LDA #$00    ;
          STA WINDOW+1 ;
          CLC         ;*2
          ASL WINDOW  ;
          ROL WINDOW+1 ;
;
          CLC         ;*4
          ASL WINDOW  ;
          ROL WINDOW+1 ;
;
          CLC         ;*8
          ASL WINDOW  ;
          ROL WINDOW+1 ;
;
          LDA WINDOW  ;SAVE *8
          STA TEMP    ;
          LDA WINDOW+1 ;
          STA TEMP+1  ;
;
          CLC         ;*16
          ASL WINDOW  ;
          ROL WINDOW+1 ;
;
          CLC         ;*32
          ASL WINDOW  ;
          ROL WINDOW+1 ;
;
          CLC         ;ADD *8
          LDA WINDOW  ;
          ADC TEMP    ;
          STA WINDOW  ;
          LDA WINDOW+1 ;
          ADC TEMP+1  ;
          STA WINDOW+1 ;
;
          CLC
          LDA X.POS   ;ADD IT TO
          ADC WINDOW  ;THE WINDOW
          STA WINDOW  ;ADDRESS
          LDA WINDOW+1 ;
          ADC #$00    ;
          STA WINDOW+1 ;
;
          CLC         ;ADD SCREEN ADDR
          LDA WINDOW  ;AND SAVE IT AS
          ADC SAVMSC  ;WINDOW AND
          STA WINDOW  ;BORDER
          STA BORDER  ;
          LDA WINDOW+1 ;
          ADC SAVMSC+1 ;
          STA WINDOW+1 ;
          STA BORDER+1 ;
;
CALCULATE.FLYBACK
          SEC         ;
          LDA #$28    ;
          SBC X.SIZE  ;
          STA FLYBACK ;
;
TEST.FISRT.WINDOW
          LDA NUMBER  ;NONE OPEN?
          BNE ANOTHER ;NO
          LDA MEMTOP  ;RESET STACK
          STA STACK   ;TO ONE BYTE
          LDA MEMTOP+1 ;BELOW MEMTOP
          STA STACK+1 ;
          JSR STACK.MINUS ;
;
ANOTHER
          INC NUMBER  ;NUMBER=+1
;
SAVE.DATA
          LDY #$00    ;GRAB DATA
          LDA (WINDOW),Y ;UNDER WINDOW
          STA (STACK),Y ;AND PUT ON
          LDA #$80    ;STACK, THEN
          STA (WINDOW),Y ;BLANK IT OUT
          JSR WINDOW.PLUS ;WINDOW=+1
          JSR STACK.MINUS ;STACK=-1
          DEC X.COUNTER ;X.COUNTER=-1
          LDA X.COUNTER ;LAST COLUMN?
          BNE SAVE.DATA ;NO
;
          DEC Y.COUNTER ;Y.COUNTER=-1
          LDA Y.COUNTER ;LAST ROW?
          BEQ SAVE.PARMS ;YES
;
          CLC         ;CALCULATE
          LDA WINDOW  ;WINDOW ADDRESS
          ADC FLYBACK ;OF THE NEXT
          STA WINDOW  ;LINE DOWN
          LDA WINDOW+1 ;
          ADC #$00    ;
          STA WINDOW+1 ;
          LDA X.SIZE  ;RESET X.COUNTER
          STA X.COUNTER ;
          JMP SAVE.DATA ;
;
SAVE.PARMS
          JSR WINDOW.MINUS
          LDA WINDOW  ;SAVE WINDOW
          STA (STACK),Y ;ADDRESS ON
          JSR STACK.MINUS ;STACK
          LDA WINDOW+1 ;
          STA (STACK),Y ;
          JSR STACK.MINUS ;
;
          LDA FLYBACK ;SAVE FLYBACK
          STA (STACK),Y ;ON STACK
          JSR STACK.MINUS ;
;
          LDA Y.SIZE  ;SAVE Y SIZE
          STA (STACK),Y ;ON STACK
          JSR STACK.MINUS ;
;
          LDA X.SIZE  ;SAVE X SIZE
          STA (STACK),Y ;ON STACK
          JSR STACK.MINUS ;
;
          LDA BFLAG   ;WANT BORDER?
          BNE WANT.BORDER ;YES
          JMP EXIT    ;NO
;
WANT.BORDER
          LDX X.SIZE  ;WIDTH=X.SIZE-2
          DEX         ;
          DEX         ;
          STX WIDTH   ;
;
          LDY Y.SIZE  ;LENGTH=Y.SIZE-2
          DEY         ;
          DEY         ;
          STY LENGTH  ;
;
          LDA BORDER  ;RESET THE
          STA WINDOW  ;WINDOW POINTER
          LDA BORDER+1 ;TO THE TOP LEFT
          STA WINDOW+1 ;CORNER
;
BORDER.TOP
          LDA #$51    ;TOP LEFT
          ORA VIDEO   ;TOGGLE REVERSE?
          LDY #$00    ;
          STA (WINDOW),Y ;
          JSR ACROSS  ;DRAW ACROSS
          LDY X.SIZE  ;
          DEY         ;
          LDA #$45    ;TOP RIGHT
          ORA VIDEO   ;TOGGLE REVERSE?
          STA (WINDOW),Y ;
;
          JSR DOWN.LINE ;WINDOW=+40
;
BORDER.SIDE
          LDA #$7C    ;
          ORA VIDEO   ;TOGGLE REVERSE?
          LDY #$00    ;
          STA (WINDOW),Y ;
          LDY X.SIZE  ;
          DEY         ;
          STA (WINDOW),Y ;
          JSR DOWN.LINE ;WINDOW=+40
          DEC LENGTH  ;
          LDA LENGTH  ;LAST LINE
          BNE BORDER.SIDE ;NO
;
BORDER.BOTTOM
          LDA #$5A    ;BOTTOM LEFT
          ORA VIDEO   ;TOGGLE REVERSE?
          LDY #$00    ;
          STA (WINDOW),Y ;
          JSR ACROSS  ;
          LDA #$43    ;BOTTOM RIGHT
          ORA VIDEO   ;TOGGLE REVERSE?
          LDY X.SIZE  ;
          DEY         ;
          STA (WINDOW),Y ;
          JMP EXIT    ;
;
```

```
;**************
;CLOSE WINDOW
;**************
;
        PLA             ;POP # OF ARG
        LDA NUMBER      ;ANY WINDOWS?
        BNE GET.INFO    ;YES
        JMP EXIT        ;NO
;
GET.INFO
        JSR STACK.PLUS  ;
        DEC NUMBER      ;ON LESS WINDOW
        LDY #$00        ;
        LDA (STACK),Y   ;POP X SIZE
        STA X.SIZE      ;
        STA X.COUNTER   ;
        JSR STACK.PLUS  ;
        LDA (STACK),Y   ;POP Y SIZE
        STA Y.SIZE      ;
        STA Y.COUNTER   ;
        JSR STACK.PLUS  ;
        LDA (STACK),Y   ;POP FLYBACK
        STA FLYBACK     ;
        JSR STACK.PLUS  ;
        LDA (STACK),Y   ;POP HI WINDOW
        STA WINDOW+1    ;ADDRESS
        JSR STACK.PLUS  ;
        LDA (STACK),Y   ;POP LO WINDOW
        STA WINDOW      ;ADDRESS
        JSR STACK.PLUS  ;
;
REPLACE
        LDA (STACK),Y   ;POP DATA FROM
        STA (WINDOW),Y  ;STACK & REPLACE
        JSR STACK.PLUS  ;
        JSR WINDOW.MINUS
        DEC X.COUNTER   ;X.COUNTER==-1
        LDA X.COUNTER   ;LAST COLUMN?
        BNE REPLACE     ;NO
;
        LDA X.SIZE      ;RESET X.COUNTER
        STA X.COUNTER   ;
        SEC             ;CALCULATE
        LDA WINDOW      ;WINDOW ADDRESS
        SBC FLYBACK     ;FOR THE LINE
        STA WINDOW      ;ABOVE
        LDA WINDOW+1    ;
        SBC #$00        ;
        STA WINDOW+1    ;
;
        DEC Y.COUNTER   ;Y.COUNTER==-1
        LDA Y.COUNTER   ;LAST ROW?
        BNE REPLACE     ;NO
        JSR STACK.MINUS ;
;
EXIT
        LDA STACK       ;PASS BOTTOM
        STA FRO         ;OF BUFFER
        LDA STACK+1     ;ADDRESS BACK
        STA FRO+1       ;TO USER
        RTS             ;
;
WINDOW.PLUS
        CLC             ;WINDOW==+1
        LDA WINDOW      ;
        ADC #$01        ;
        STA WINDOW      ;
        LDA WINDOW+1    ;
        ADC #$00        ;
        STA WINDOW+1    ;
        RTS             ;
;
STACK.PLUS
        CLC             ;STACK==+1
        LDA STACK       ;
        ADC #$01        ;
        STA STACK       ;
        LDA STACK+1     ;
        ADC #$00        ;
        STA STACK+1     ;
        RTS             ;
;
WINDOW.MINUS
        SEC             ;WINDOW==-1
        LDA WINDOW      ;
        SBC #$01        ;
        STA WINDOW      ;
        LDA WINDOW+1    ;
        SBC #$00        ;
        STA WINDOW+1    ;
        RTS             ;
;
STACK.MINUS
        SEC             ;STACK==-1
        LDA STACK       ;
        SBC #$01        ;
        STA STACK       ;
        LDA STACK+1     ;
        SBC #$00        ;
        STA STACK+1     ;
        RTS             ;
;
ACROSS
        LDY #$01        ;
        LDX WIDTH       ;
        LDA #$2         ;
        ORA VIDEO       ;TOGGLE REVERSE?
;
L1
        STA (WINDOW),Y  ;STORE IT
        INY             ;
        DEX             ;LAST ONE?
        BNE L1          ;NO
        RTS             ;YES
;
DOWN.LINE
        CLC             ;WINDOW==+40
        LDA WINDOW      ;
        ADC #$28        ;
        STA WINDOW      ;
        LDA WINDOW+1    ;
        ADC #$00        ;
        STA WINDOW+1    ;
        RTS             ;
;
TEMP    .BYTE 0,0
BFLAS   .BYTE 0
Y.POS   .BYTE 0
X.POS   .BYTE 0
X.SIZE  .BYTE 0
Y.SIZE  .BYTE 0
X.COUNTER .BYTE 0
Y.COUNTER .BYTE 0
FLYBACK .BYTE 0
VIDEO   .BYTE 0
BORDER  .BYTE 0,0
NUMBER  .BYTE 0
WIDTH   .BYTE 0
LENGTH  .BYTE 0
```


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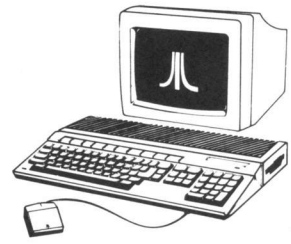

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CIRCLE #112 ON READER SERVICE CARD

Database Delphi

News and updates about the *ANALOG Computing* Atari Users' Group on Delphi

by Matthew J.W. Ratcliff

The membership of the Atari SIG on Delphi has tripled in the two months since **ANALOG Computing** took over its sponsorship. And nearly every time I log on, I get involved in an interesting conference.

Dan Moore, author of **PaperClip**, is currently developing **PaperClip Elite** for the ST. He's quite active in the forum and has been kind enough to answer a lot of technical questions about software development on the ST. This month, we'll look at some of the new files available for downloading, plus a couple of polls and some of the more interesting messages from the forum.

Not all good article submissions can be published in our magazine—for many reasons. The program may be too long, or it may have a limited audience. Some of these programs, which **ANALOG Computing** feels should be shared, are being put up in the Delphi database areas. The authors will be mentioned here—and paid for their work.

This time, we have another modification for the immensely popular **Home-made Translator** (**HMT**) by Angelo Giambra, from issue 32. The latest update is a *Font Changer*, by Larry Nocella. This BASIC program, with some speedy assembly language USR routines, will load any font of your choice and write out to your **HMT** AUTORUN file. It gives you a custom font in your custom operating system, a real touch of class.

Charles F. Johnson (username CFJ), one of our most active "siggies" and author of **G:** (issue 35) and the **Koala Slideshow Program** (issue 40), has done it again. His newest 8-bit program is the *Player/Missile Creator*. This BASIC and assembly program enables you to edit two P/M graphics shapes simultaneously. The editor is sophisticated and easy to use. As you edit two players, you can see their combined results in developing a three-color player. As the two shapes are edited, side by side or overlaid, you can also see the actual P/M graphics simultaneously. Help and mini-DOS screens are readily accessible from this program, as well. The end results of your fancy players and missiles may be written to disk as BASIC DATA statements, .BYTE statements for MAC/65 or Atari Assembler/Editor, or DB statements for the Atari Macro Assembler.

In the Piracy Poll created by STEVE-GRIMM, 93 percent of those responding claimed that pirated software was not their primary source of programs. One echoed the sentiments of most: "I dislike pirating. It spoils it for the rest of us. I hate copy protection, and pirating is the cause of it." Most of the replies indicated that users pirated for the 8-bit (to some degree), but absolutely do not for their ST system. Many correctly fear that pirating software for the ST will kill its software market.

One of our readers, TELEDATAAUST from Melbourne, Australia reported: "the ST is going strong down here. Recently, we had a PC show—the largest for the year—and one of the star attractions was the ST. There are about 500 or so STarians at the moment throughout the country, and it's growing!" Our SIG has had visitors from Germany and Canada, as well.

I had hoped to have more messages for you from my EMAILbag, but they were all destroyed, due to my unfortunate lack of familiarity with Delphi. I thought I'd pass this *caveat* along to you. When reading messages in the forum, you can FILE the current message in your workspace, for downloading later if you like. Well, I was using FILE in EMAIL, since it's a valid command there. The problem is that, in EMAIL, your message is stored in a compressed format. You must reread it from EMAIL to get it uncompressed. You can download a filed piece of mail, but you won't make much sense out of it. To save your mail in a simple text file, you must EXTRACT it at the MAIL> prompt. This, and a few other inconsistencies in the Delphi command structure, take a little getting used to.

In the forum, the topic of dealer support versus mass merchandiser and mail order sales came up. Atari seems to want to support its specialty dealers, but also wants to sell many more machines through Toys 'R' Us and other chains. The INSPECTOR, a software and hardware dealer, pointed out the problem from his view. . .

"I believe you can see from the responses that there are problems out in the computer world with dealers getting support. Atari is by no means the only one giving dealers problems, but if Atari could do better than others in this area, I believe it would greatly benefit (all Atari dealers). If you look at the problem from the dealer's standpoint, you can see pressure coming from the consumers. Most people can't wait for long delays in the receipt of equipment or software. This puts immense pressure on the dealer to avoid the loss of a sale. What really irritates me is when a customer buys a piece of software or hardware

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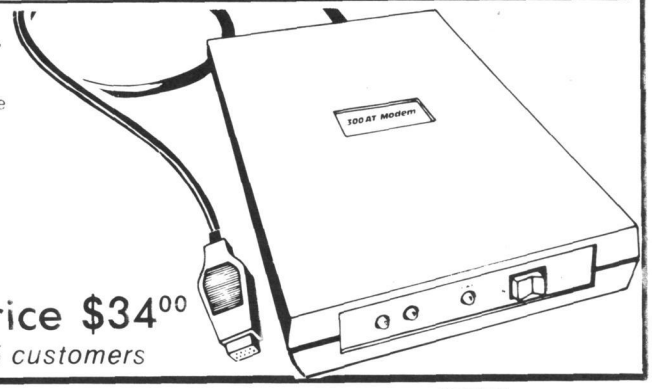

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at a mass merchandiser, then comes to the local dealer for support. We need money to survive. We don't charge for the help, and it takes time to help a lot of these people through their problems. I think you can see why a dealer fears competition from K-Mart or others. We lose sales, because they can undercut us—and we have to support their customers, because their salesmen or women don't know a byte from a bite. All in all, I hope both machines (the ST and Amiga) eat Apple's and IBM's lunch."

For all you 8-bit diehards out there: you'll find a new file up in the games database, called *The Death of an Apple*, submitted by CUBFANANDBUDMAN (now there's a username). This is a graphics and sound demo that's. . .well, *killer!* It was written and placed in the public domain by Scott Emond. This duel to the death between Atari and Apple multicolor logos is a must.

For you newcomers, Charles Bachand has been archiving groups of forum messages in the general interests database. Product reviews and computer show reports are archived here, too.

In the ST programs database, you'll find some new MIDI goodies, sent up by CANNONBALL. DFSCOTT has sent up a RESET-proof RAMdisk for the ST.

That about covers the latest in the Atari Users' Group SIG on Delphi. I'm currently working on a serial story board. We'll begin a tale of adventure, let you read along and even let you post new chapters, if you like. I hope it's up and running by the time you read this. We have no formal conferences arranged just now. I'll try to make myself available for conferencing on Sunday evenings and I'll post an announcement by Wednesday, regarding upcoming conference schedules.

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CIRCLE #105 ON READER SERVICE CARD

THIS MONTH:

Near letter quality for the masses, remote controls and a 5¼-inch drive for the ST.

Arthur Leyenberger is a human factors psychologist and free-lance writer living in New Jersey. He's been an Atari enthusiast for four years and continues to be an Atari enthusiast. When not computing, he enjoys playing with robotic toys.

CompuServe — 71266,46
Delphi — NJANALOG

by Arthur Leyenberger

Let me just finish wiring up these AB-619 condensers. There. Electronics Service, Unit No. 16, sure has a complete selection of components. Their catalog says: "components incorporating greater advances than hitherto known in the field of electronics." Anyway, I hope I've got all these parts wired correctly. Maybe now I'll find out what an Interociter is.

It's beginning to get chilly here. Makes me think about vacationing somewhere warm. Maybe I'll do Metaluna this year. Sometimes it's hard to concentrate on the work at hand. What was I saying. . .oh yes, welcome back to **The End User**. Let's get things rolling.

It's truly amazing to see computer hardware prices fall as rapidly as they have in the last couple of years. Four years ago, an Atari 800 which had 16K of memory was $800.00. Three years ago, an Atari 800XL with 64K of memory went for $350.00. Two years ago, an 800XL set you back perhaps $200.00—and now you can get one for $80.00. The same kinds of price reductions have occurred with a lot of computer hardware.

Take printers, for example (please). Four years ago, the most popular printer in my area was the Epson MX-80 with Graftrax (a dot-graphics enhancement). This printer could be had for only $500.00. Today you can pick up the equivalent printer, an Epson FX-85, for about $350.00. Not only has the price come down, but many features have been added to this—as well as other—printers.

One of the more popular enhancements for dot-matrix printers is called near-letter-quality (NLQ) printing. Many of the mid-priced printers now come with this feature, which allows the printer to simulate letter-quality output by making multiple passes at each line. Rather than using the printer's normal font, NLQ is more precisely formed, to resemble characters produced by a typewriter. Text printed in NLQ mode looks quite good (although, if inspected closely, its dot heritage still shows).

Unfortunately, those who already have a printer without NLQ may balk at spending a few hundred dollars for another printer. For them, a new product from Carolina Engineering Laboratories (CEL, at 818 Tyvola Road, 109, Charlotte, NC 28210 — (800) 222-9073) could be of interest. Called the **StyleWriter**, this accessory can produce NLQ printing with just about any printer (Epson and compatibles, C.Itoh and Okidata). Here's the scoop.

StyleWriter is a black box connected between the computer and either a serial or parallel interface printer. It receives the output of the computer, interprets it and produces the desired result automatically. This is not magic—all special print commands to the **StyleWriter** are preceded by a backslash (\). All commands are one-letter abbreviations, such as \B for bold, \U for underlining, \I for inverse printing, etc. Your printer doesn't need to be able to underline or print boldface, for example, in order for **StyleWriter** to work.

It also has a couple of clever, useful print enhancements not available in any other product I've seen. There's double underlining, which, like regular underlining, can be done either continuously (including spaces) or just with words. Another fea-

The End User

ture called highlighting gives text an interesting look by printing it over a slightly shaded background.

StyleWriter is more than just a dumb black box. An 8085 microprocessor runs the whole show, which consists of a minimum 8K of RAM for buffering, software on ROM and up to six font ROM chips (at $13.00 each). Almost twenty different fonts are available, including Roman, Sans Serif, Courier, Century, Old English, and many more.

Buffering allows the computer to send output as fast as it can to the buffer memory, while the printer prints as fast as it can. Since printers normally print much more slowly than computers can send output, a buffer frees up the computer for other tasks while the printer keeps on working. Otherwise, the computer would be continually communicating with the printer until all of the text was printed. **StyleWriter**'s 8K buffer can be increased in size to 128K. This allows approximately 65 average pages of text to be printed independently.

StyleWriter contains just three pushbuttons (ON/OFF, NLQ ON/OFF and RESET) to clear the buffer. When ordering, you must specify your make and model of printer, and your three desired type fonts, which come with **StyleWriter**. The 8K buffer version lists for $198.00; 64K buffer and 128K buffer models are available for $228.00 and $258.00, respectively. These prices aren't all that high, when you consider the cost of a printer buffer alone.

The combination of buffering, command flexibility, speed of operation and low cost make **StyleWriter** a logical addition to your existing system. Best of all, it can be used with either an 8-bit or 16-bit Atari computer. Quality of construction is first-rate, as well. As long as you've a word processor in which you can embed **StyleWriter** commands, you can produce near-letter-quality output inexpensively, in a number of fonts.

A remote turn-on.

I used to scoff at the idea of turning your lights on and off from a remote control. At the time, I thought it was pure decadence to do so. That was before I learned about the **System X-10** from BSR, now simply called **X-10** from X-10 USA, Inc., 185A LeGrand Avenue, Northvale, NJ 07647 — (201) 784-9700.

The **X-10** system is composed of modules that control AC-operated devices—lights, appliances and other electrical equipment—and a controller used to turn them on and off. Since the controller signals the modules via the AC lines, there's no need for special wiring, just one module for each device you want to control.

Each module comes with switches for you to set its identity. One switch is labeled *House Code*, and the other *Unit Code*. The two settings together make up the unique "name" of the individual **X-10** unit. When you press a button to, say, turn on the bedside lamp, the controller sends out orders by, in effect, calling out the name of the unit and telling it what to do.

A number of products make up the **X-10** system. A manually operated remote control can be used to "give orders" to your electrical devices immediately. You can have as many controllers as you want on your house's AC lines. The **X-10** Timer contains a clock and has the ability to store two on-times and two off-times for up to eight **X-10** modules. In addition, each device can be turned on or off every day at an exact time or at random times (plus or minus a half-hour from the time you enter). This is the so-called security feature, to give your house a "lived-in" look when you're away.

Once the unit's been programmed, your coffeepot can start perking at 6:00 a.m. (assuming you filled it the night before), your bedside, porch and garage light come on at 6:30 a.m.—and be turned off after you leave. Later, the porch light may come on fifteen minutes before you arrive home, then turn off at 10:00 p.m. Thus, two complete on/off cycles would have been programmed.

The **X-10** Timer is somewhat tedious to program. Further, although newer timers have a battery backup, most older ones don't—whenever power is interrupted, the Timer's memory is lost, requiring you to reprogram. Fortunately, X-10 has gone a step further and come out with the Powerhouse.

This is a computer peripheral that replaces the Timer and works with a variety of computers, including the Atari ST. It can operate and change the daily schedule of lights, appliances and other electrical devices automatically, by remote control. Essentially, it's an **X-10** Timer programmed by the computer—and it is, therefore, more convenient to use.

The **X-10** Powerhouse is attached to the RS-232 port of the ST. The unit is self-powered, and, once programmed, can be disconnected from the computer—freeing that port for other uses. Although X-10 only makes software for the IBM PC, Apple II and Commodore computers, MichTron, a

familiar name to many, has a new program called **Echo** ($40.00, from MichTron, Inc., 576 S. Telegraph, Pontiac, MI 48953 — (313) 334-5700) created specifically for the **X-10** Powerhouse, all of the **X-10** products and Atari ST computers.

Echo allows you to use the **X-10** system to change the status of up to 256 electrical devices at a maximum of 128 different times in a week. For you VCR fans, that's a 7-day, 128-event system. At any time, up to sixteen devices can be turned on, turned off, or dimmed—in one event. The system will do exactly what you tell it to, even if it's silly or dangerous (you could turn on—and probably burn up—an empty coffeepot).

Echo is a GEM application, so all entries are done via the mouse, and desktop accessories are always available. To create a new event or to modify an existing one, you click on the event line of the control menu. Up pops a new screen where you can enter your assignments and save them in a file. This lets you store alternate timing schedules on disk for use later (like when you're going on vacation).

Once you've created your set of assignments and stored them, the computer can be turned off and the RS-232 connection removed. The **X-10** Powerhouse will silently control your home. A 9V battery protects the controller's memory in case of a power outage.

Lamp and appliance modules sell for $10.00 to $15.00 at Sears, Radio Shack, mail order and electronics specialty stores. In addition, replacement wall switches and outlets that look and work like ordinary fixtures, are available for under $15.00. The Clock Timer can be purchased for under $40.00, and a controller for less than $20.00. The Powerhouse peripheral retails for $60.00.

I was skeptical of the entire **X-10** concept before using it; I'm now a true believer. The system really does serve many roles, including that of a security system. I've grown used to the **X-10** as an "electronic servant," to wake me with fresh coffee and lighted rooms, while letting me sleep in on Saturdays. Outdoor lights come on at dusk and go off at dawn automatically, and it controls my water heater and air conditioner, to save energy (and money). The **X-10** system makes my life easier and safer.

Disk jockey.

My twenty-year-old *American Heritage Dictionary* defines the word *paradox* as: "A seemingly contradictory statement that may nonetheless be true." I define Paradox Enterprises, Inc., as a new company that just happens to have an interesting, useful and (I guess) paradoxical product called the **Microbyte**.

The **Microbyte-A** is a 5¼-inch floppy disk drive for the Atari ST that comes (as we used to say in my slot-car racing days) ready-to-run. For $270.00, you get a rugged 360K-capacity drive housed in a metal case, an AC power adapter module, a 5¼-inch and a 3½-inch floppy disk. The ST disk cable is permanently attached to the drive on one end and has a drive connector on the other.

Setup is simple. The power adapter is plugged in and connected to the **Microbyte**; the **Microbyte** is connected to an Atari ST drive; the system is turned on; and a file is copied from one of the supplied floppies to an AUTO folder on the disk in the A drive. In this configuration, the **Microbyte** driver program will run whenever the system is booted. Alternatively, the driver program can be run at any time, in order to use the **Microbyte**.

In addition to letting you store ST programs and files on 5¼-inch floppy disks, the **Microbyte**'s main use is for file compatibility with an IBM PC or clone. IBM PC floppy disks can be read directly by your ST when placed in the **Microbyte** drive. Of course, what we're talking about here is ASCII file compatibility. Any ASCII file created by an MS-DOS PC can be read by your ST—and vice versa.

How does it all work? Very nicely, thank you. I was able to read ASCII text files created by my AT&T 6300 PC on the ST, and **1st Word** files on the AT&T PC, without a hitch. In addition, I could read Lotus 1-2-3 data files directly by **VIP Professional** (in WKS mode).

My only (minor) complaint is that the ST drive cable plug doesn't precisely fit the jack on the ST drive. Once I got it in, everything worked. Since my unit was a prototype, you may not have this problem with the production drives.

Paradox Enterprises was started less than a year ago. In addition to the **Microbyte-A** (PC and PC-XT compatible), they have a **Microbyte-B** drive for the IBM PC-AT. It sells for $280.00 and stores 720K on a disk. Both drives are currently available.

The company is also working on an IBM emulator for the ST. Called **MS.EM**, it is said to be near completion and should be available by the time you read this. It offers MS-DOS emulation through software—an ST cartridge. The emulator mimics a Hercules Color Card and runs such programs as Lotus 1-2-3, Wordstar, dBase II and III, and others. It will sell for under $150.00, from Paradox Enterprises, Inc., 8444 E. 19th Street, Tucson, AZ 85710.

Another product, still in the design stage, is the **ParaBox**. It will allow the Atari ST to use IBM cards (extra serial ports, hard disk controllers, etc.) I'm told that the **ParaBox** will plug into the ST cartridge port and probably provide an extra cartridge port on the box itself.

If you need it, the **Microbyte** is a useful and well designed product. It was folks like these who launched the whole computer industry not very long ago.

Mourning a friend.

The premature death of anyone is difficult to take, let alone understand. It's especially saddening when that person is young—both physically and spiritually. Such is the case with Frank Pazel, who recently succumbed to cancer.

Many of you knew Frank as the editor of the Jersey Atari Computer Group newsletter. In this capacity, he was the most dedicated person I've ever met. But his dedication and commitment to *all* aspects of his life were what made him a special person. Whether it was setting up the best Atari computer lab in New Jersey (in the Mountain Lakes High School), turning an interest in magic into a part-time profession, becoming a private pilot, or his extraordinary efforts on behalf of the JACG —whatever Frank did, he did well. And he was one of those people who always did exactly what he said he would do, or more.

Frank Pazel was a friend to all Atarians. The JACG, the greater Atari community and I will miss him.

CIRCLE #117 ON READER SERVICE CARD

Bits & Pieces

This month, our hardware utility series shows you how to make a light pen.

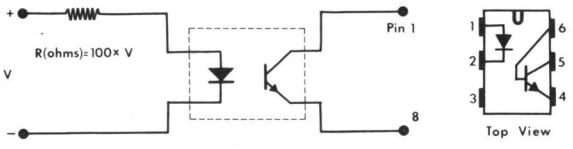
by Lee S. Brilliant, M.D.

"An Apple a day keeps the doctor away." Or how about "All things in moderation?" Well, too much of a good thing is bad for you. So, this'll be the last of the articles on the digital uses of the joystick ports. But, never fear, there's much more to come about Atari's hardware capabilities, including many simple and useful projects.

There are analog inputs to the joystick ports, as well as to the serial port, audio-video port, power plug and parallel ports. Actually, they're there for you to use—if you know how.

This article will examine more ways to use the joystick digital inputs, including the trigger inputs. Next month, we'll conclude our discussion of the joysticks with the analog inputs.

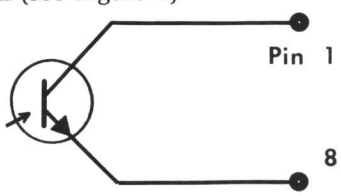
Back in the third article, we used an optical isolation device called an optoisolator, which is an LED encapsulated with a phototransistor, or a triac. So far, we've used the computer to drive the LED half, but we can turn things around to sense the presence of outside voltages, or to recognize if a piece of equipment is turned on (see Figure 1).



TIL-111 or 4N26 or equivalent

Figure 1. — Optoisolator voltage detector.

Actually, you can cut an isolator in half and use the phototransistor to detect the presence or absence of external light, but it's easier to buy a separate phototransistor and connect it to the input of the joystick port. A phototransistor is one which conducts current when light hits its exposed internal workings, and it acts like a switch attached to the joystick pin (see Figure 2).



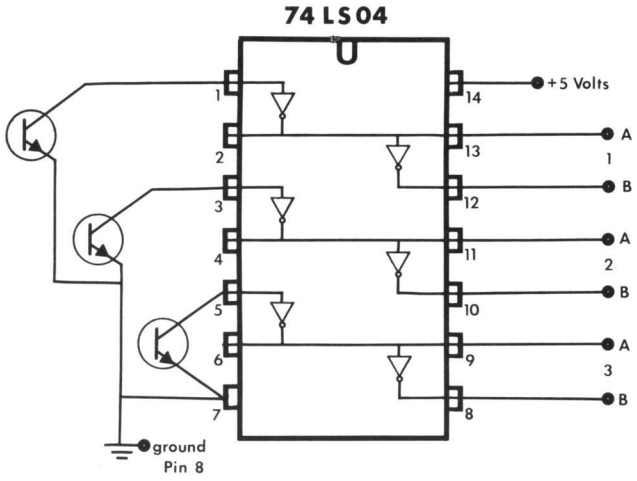
Radio Shack 276-145

Figure 2. — Phototransistor input.

When light strikes the phototransistor, it changes the state of the joystick pin from 1 to 0. In this setup, the light beam must be very strong. An intermediate strength beam can create an ambiguous logic state as the input fluctuates. A better approach is shown in Figure 3 (next page).

This uses a 74LS04 hex inverter, so called because it contains six inverter circuits in a single IC. An inverter simply changes the logic of the input signal to the opposite state, so if the input is at logic 1, then the output is at logic 0—and the other way around. Be sure to use an LS series IC, not a standard 74 series. The LS chips use less power, so less light is needed to trigger the inverter to change state.

Using this circuit gives you more reliable switching plus both a *1* and a *0* output (the A and B wires),



74LS04 and 3 Radio Shack 276-145s

Figure 3. — Three channel optical event sensor.

for either the presence or absence of light. Remember that a logic gate in the 0 state is like a short circuit to the joystick pin. So, as wired, a beam of light on sensor 1 would cause a *1* output from the first inverter at IC pin 2, which is chained to the input of inverter 6 at pin 13, and causes a *0* output from pin 12. A small cardboard tube or rolled up black paper placed over the end of the sensor makes it more directional.

Using the optical sensor.

What use is this small circuit? Well, are there any Boy Scouts out there? If there are, then you're probably familiar with the Pinewood Derby. Each Scout is given a wooden blank from which he sculpts a racing car. They then compete to see which car is the fastest.

We built a three-lane ramp track, and installed a set of three sensors and lamps at the end of the track. The program sensed which car was first, second and third, and also measured the elapsed time of each run. The program even registered the contestants, assigned the heats, controlled the starting gate (a three-color starting pole), generated the sound of three engines revving, and could also say, *Drivers, start your engines!* How's that for an application of your "lowly" Atari?

All this razzle-dazzle can be done through the joystick ports, using the simple controllers described in this and previous articles. The three-color starting pole used the high-powered light controller, and the voice was synthesized with **Cheep Talk** (issue 29). The same photodetector circuit used in the racetrack can also be used to build a light pen: read on.

The operating system.

Hardware is useless without software, so let's see how your Atari handles the hardware. The Apple, Commodore 64, and the Atari all use the same microprocessor, have 64K of memory, input/output systems, sound, graphics and more. What makes Atari so much better? First is the use of special hardware such as ANTIC and POKEY, but the main difference between otherwise similar computers is in their operating systems.

The Atari OS is unique in its use of what are called "shadow registers". These are locations in RAM which hold a value used by the hardware, such as the screen color used by ANTIC. The OS reads these shadows and writes the contents to the hardware sixty times a second during the interval between the drawing of each video screen. Changing the shadow changes the hardware register in between screens.

Conversely, the content of some hardware registers is transferred to the RAM. Included in this group are the states of the joystick pins, which are transferred from the hardware at 54016 to RAM at 632 for plug 1, and 633 for plug 2. BASIC reads these locations with the commands STICK(0) and STICK(1). The states of the joystick triggers are transferred from locations 53264-53267 to 644-647 and can be accessed by the BASIC STRIG(0-3) command. Note that on 400/800 computers there are four joysticks and triggers. On the newer lines there are only two, so we'll study only joystick ports 1 and 2.

The transfer to shadow registers occurs every $^1/_{60}$ second, or every 17 milliseconds (.017 seconds). This may seem fast to you, but consider that the response time of the phototransistor is measured in nanoseconds, (or millionths of a millisecond). It's easily possible for the sensor to respond to a break in the light beam so quickly that the joystick pin returns to its resting state before BASIC (or even the OS) can sense it.

The 6502 processor, operating at top speed, can sample the state of the joysticks every five machine cycles or every 2.8 microseconds. Listing 1 is a BASIC/machine program that will work with either the three-channel optical sensor (using the *A* outputs) to detect breaks in three light beams, or with three pushbuttons attached to the joystick, to create the heart of the TV quiz game. This is the core of the program which was used for the Pinewood Derby. For demonstration, you can use a joystick simulating three optical events with the forward, backward and left motions, to imitate three optical events or buttons pushed.

Type and save the program, then run it and see how fast you can go through all three motions. No matter how I tried, I couldn't do any two motions in less than $^2/_{60}$ second—so the program can discriminate order of events to 35 microseconds, but can only resolve time to $^1/_{60}$ second. This timer is good for most applications, but ties up the processor and prevents it from doing anything else.

Fortunately, there's another way to detect short events without tying up the processor: use the trigger inputs! Plug a joystick into plug 1 and try the following program:

```
100 PRINT STRIG(0):GOTO 100
```

When you run this program, you should see a long line of *1*s until you press the trigger. Then you'll see *0*s, as long as you hold down the button. Now add the following lines and run again:

```
50 GRACTL=53277
60 POKE GRACTL,4
```

As before, you'll see *1*s until you press the trigger, and then *0*s. But this time the *1*s won't come back once the trigger is released. This "latch" is controlled by bit 2 of GRACTL (a contraction of GRAphics ConTroL) at location

53277. A *1* in bit 2 (4 in decimal) sets the trigger latch, while a *0* clears it. So, to reset the trigger register to *1*, poke GRACTL with *0*. If you hook the photo sensor into the trigger line (instead of the joystick pins) and set the trigger latch, then any optical event, no matter how short, will be captured and held for as long as you want. It will show up in both the hardware and software registers until you reset GRACTL. The only problem is that the triggers are not independent. They're either all latched or not, either all reset or set. This kind of "sample-and-hold" electronics frees the main processor from having to constantly monitor the inputs to detect short events.

Light pens.

Besides the latch, one other thing happens whenever any trigger input is set to *0*: the GTIA hardware notes where the electron beam is on the screen face, and records the column and row into hardware registers (which are then copied into RAM by the OS during the vertical blank). The hardware locations are 54284 for the column and 54285 for the row, with the respective shadows being 564 and 565.

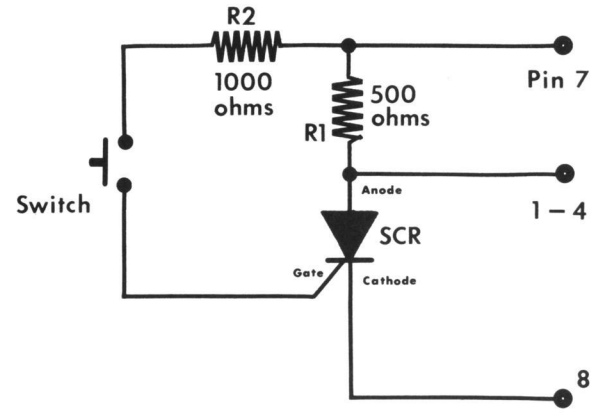
These column/row values are not like those in the graphics screens. The row values correspond to the scan lines on the screen and run from about *16* to *111*, depending on how much of the picture is actually displayed by your TV. Similarly, the column value is in "color clocks" and goes from about *67* on the left to *227*, then wraps around to about *7* on the right. Again, the amount of picture which is actually displayed will vary these values, and the positions are unaffected by the graphics mode.

All we need to do is build one-third of the light sensor in Figure 3, attach the B output to the trigger line (pin 6 on any joystick) and presto—instant light pen! Use the parts listed in Figure 3 and assemble on a thin piece of perf board, or make a small printed circuit. I added a small pushbutton (Radio Shack 275-1571) which switches joystick pin 1 to make it compatible with other light pens. This little device works because the output is *1* when there's no light on the sensor. As the electron beam crosses the field of the phototransistor, it causes conduction and produces a *0* input to the joystick trigger, which in turn causes the light pen values to be updated. Total cost is about $10.00. I don't pretend that this is a professional quality light pen, but the circuitry is similar to another light pen I bought a couple years ago.

Mine is very accurate on the row, but often scatters on the column position. You can use the pen to make menu selections, draw on the screen, or perform other inputs. Listing 2 is a short example of how to use the light pen. the luminance of the screen must be high to trigger the pen, usually *10* or *12*.

Finally.

If you're an Atari diehard (as I am), you may still be using an 800 or 400. If you are, you're lucky enough to have four joysticks to use—comprising a full 16-bit input/output port with four latchable trigger lines. If you use a newer version, you only have two, but you also have a full 64 or 128K of memory available. Unfortunately, there are always tradeoffs. But, if you have an XL or XE and need more than two trigger lines, or need to have individually resetable latches, then you can use the following circuit on any joystick pin to create a pseudo-latch.



Radio Shack 276-1067 or any SCR

Figure 4. — Latch circuit.

This circuit uses the properties inherent in a Silicon Controlled Rectifier (SCR) to act as a latch. SCRs were originally designed for use in power control circuits, to chop up house current—such as in light dimmers. They allow current to flow only in one direction, but not until the gate is opened. Once current flow begins, it continues until the flow drops below a certain minimum level (similar to a toilet tank starting with the flush, not stopping until the tank is empty). Flow stops when house current changes direction, every $^1/_{60}$ second. The SCR will then not allow the backward flow; current drops to 0; and conduction stops until the next gate trigger.

In any case, momentarily closing the switch in Figure 4 causes the SCR to start conducting. This acts like a short on the input line and registers a *0* for that pin. R1 is needed to increase the current flow to exceed the minimum latch needs. If isolation is needed, use a Radio Shack 276,134 optoisolator with triac output (a triac is two SCRs back to back, to allow current flow in both directions), as in Figure 1. To reset the latch, turn the joystick port around to output and drop the latched line to *0*, thereby shorting the current flow around the SCR and stopping conduction. Finally, return the port to input:

```
5 REM SEE BITS 'N PIECES #3
10 PORTA=54016:PACTL=54018:RESET=PEEK(
PACTL):SET=RESET-4
100 VALUE=PEEK(PORTA):IF VALUE=255 THE
N 100
110 ? VALUE;CHR$(253)
120 POKE PACTL,SET:POKE PORTA,255:POKE
 PACTL,RESET
130 REM SETS PORT A TO OUTPUT
140 POKE PORTA,VALUE:REM LATCH OFF
150 POKE PACTL,SET:POKE PORTA,0:POKE P
ACTL,RESET
160 REM RETURNS PORTA TO INPUTS
170 GOTO 100
```

The last. . .finally.

At last we come to the end. Next month, we'll look at analog or paddle inputs and, ultimately, construct a mouselike device to aid in text editing. Until next month: happy circuits, and keep tinkering. A

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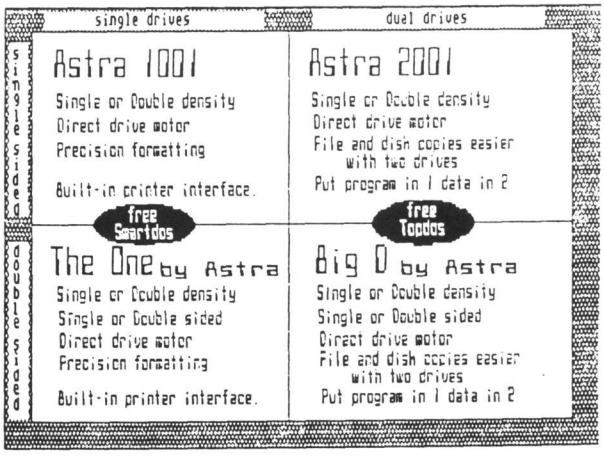

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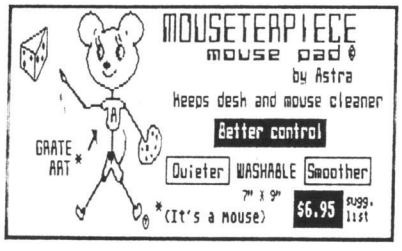

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Listing 1.
BASIC listing.

```
PE 10 DATA 104,169,0,162,0,157,0,6,232,22
   4,12,208,248,133,18,133,19,133,20,169,
   1,133,204,165,204
EJ 20 DATA 201,4,240,68,173,0,211,73,255,
   41,7,240,247,133,203,162,0,160,0,165,2
   03,70,203,41,1
IP 30 DATA 208,11,232,200,200,200,224,3,2
   08,240,76,35,6,189,0,6,208,232,165,204
   ,230,204,157,0,6
GL 40 DATA 232,165,20,153,3,6,200,165,19,
   153,3,6,200,165,18,153,3,6,200,76,68,6
   ,96
CR 50 FOR S=0 TO 97:READ D:POKE 1548+S,D:
   NEXT S
UJ 55 REM INSTALL MACHINE LANGUAGE TIMER
   IN PAGE 6
MG 60 ? CHR$(125);CHR$(253);CHR$(253);" P
   RESS TRIGGER TO START TIMER"
XZ 70 IF STRIG(0)=1 THEN 70
SD 80 ? CHR$(125);"----------TIMING------
   --"
KR 100 A=USR(1548):REM START TIMING CYCLE
   .  RETURN TO BASIC ONLY AFTER 3 EVENTS
    RECORDED.
HZ 105 REM THE ORDER IS STORED IN 1536 TO
    1538, TIMES IN 3 BITE INCREMENTS FROM
    1539 TO 1547
SW 110 ? "R":? "CAR 1","CAR 2","CAR 3"
DH 120 ? PEEK(1536),PEEK(1537),PEEK(1538)
RB 130 ? "   ******** ELAPSED TIME ******
   **"
TP 140 TIME1=PEEK(1539)+256*PEEK(1540)+25
   6*PEEK(1541)
ZE 150 TIME2=PEEK(1542)+256*PEEK(1543)+25
   6*PEEK(1544)
LJ 160 TIME3=PEEK(1545)+256*PEEK(1546)+25
   6*PEEK(1547)
NZ 170 ? TIME1,TIME2,TIME3
ZY 180 REM TIME IS IN 60THS OF A SECOND
```

Listing 2.
BASIC listing.

```
VI 10 REM ******************
OI 20 REM *LIGHT PEN       *
WM 30 REM *by Lee Brilliant*
VL 40 REM ******************
LH 80 PORTA=54016:XOFFSET=80:YOFFSET=18
IM 84 REM +++++++++++++++++++++++++++++++
MJ 85 REM "     XOFFSET AND YOFFSET
          WILL VARY WITH EACH LIGHTPEN
              AND TV COMBINATION
IQ 86 REM +++++++++++++++++++++++++++++++
UU 90 GRAPHICS 0:POKE 710,0:POKE 709,14
IJ 100 ? "R":? :? "  ■■■":? "  ■■■ 1. GRA
   PHICS 3":? "  ■■■"
ZB 110 ? :? "  ■■■":? "  ■■■ 2. GRAPHICS
   5":? "  ■■■"
DE 120 ? :? "  ■■■":? "  ■■■ 3. GRAPHICS
   7":? "  ■■■"
ZL 125 POKE 564,0:POKE 565,0
PS 130 IF PEEK(PORTA)=255 THEN 130
OX 140 X=PEEK(564)-XOFFSET:Y=PEEK(565)-YO
   FFSET
TF 150 IF X<12 OR X>25 THEN 125
IP 160 IF Y>7 AND Y<17 THEN GR=3:MAX=40:G
   OTO 300
MK 170 IF Y>22 AND Y<32 THEN GR=5:MAX=80:
   GOTO 300
AU 180 IF Y>40 AND Y<50 THEN GR=7:MAX=160
   :GOTO 300
PC 190 GOTO 125
DK 300 GRAPHICS GR:POKE 712,14:POKE 708,0
   :DIV=7-GR:COLOR 1
KI 310 IF PEEK(PORTA)<>255 THEN 310
JU 320 XLIM=MAX-1:YLIM=MAX/2-1:DIV=7-GR
SA 330 IF PEEK(PORTA)=255 THEN 330
DQ 340 X=PEEK(564):Y=PEEK(565)
TG 350 IF X<25 THEN X=X+228
VT 360 X=X-80:Y=Y-18
SQ 370 IF  NOT DIV THEN 390
WD 380 X=X/DIV:Y=Y/DIV
EY 390 IF X<0 THEN X=0
QH 400 IF X>XLIM THEN X=XLIM
FI 410 IF Y<0 THEN Y=0
ST 420 IF Y>YLIM THEN Y=YLIM
TB 430 PLOT X,Y
MH 440 GOTO 320
```

Listing 3.
Assembly listing.

```
;******************
;*DERBY TIMER     *
;*by Lee Brilliant*
;******************
;
;---------------
;SYSTEM EQUATES
;---------------
;
HOLD    =   203
COUNT   =   204
PORTA   =   54016
;
;---------------
;START TIMER
;---------------
;
        *=  $0600
CAR     .BYTE 0,0,0
TIME    .BYTE 0,0,0,0,0,0,0,0,0
        PLA             ; NEEDED FOR USR
        LDA #0          ;CLEAR BUFFERS
        LDX #0
CLEAR   STA CAR,X
        INX
        CPX #12
        BNE CLEAR
        STA 18          ;ZERO CLOCK
        STA 19
        STA 20
        LDA #1
        STA COUNT
START   LDA COUNT       ; ALL 3 EVENTS?
        CMP #4
        BEQ EXIT        ;YES, THEN QUIT
SENSE   LDA PORTA       ;DETECT EVENT
        EOR #255        ;INVERT RESULTS
        AND #7          ;LOWER NIBBLE
        BEQ SENSE       ;IF NO EVENTS,
                        ;THEN LOOP
        STA HOLD        ;STORE RESULTS
        LDX #0
        LDY #0
SELECT  LDA HOLD        ;TEST BITS
        LSR HOLD        ;ONE AT A TIME
        AND #1
        BNE ALREADY     ;EVENT OCCURRED
NEXT    INX             ;NO EVENT,
                        ;ADVANCE BUFFER
        INY
        INY
        INY
END     CPX #3          ; ALL BITS TESTED?
        BNE SELECT      ;NO, TRY AGAIN
        JMP START       ;YES START AGAIN
ALREADY LDA CAR,X       ;EVENT RECORDED
                        ;ALREADY?
        BNE SELECT      ;YES, KEEP TESTING
RECORD  LDA COUNT       ;NO,RECORD RESULT
        INC COUNT
        STA CAR,X       ;RECORD ORDER
        INX
        LDA 20          ;RECORD TIME
        STA TIME,Y
        INY
        LDA 19
        STA TIME,Y
        INY
        LDA 18
        STA TIME,Y
        INY
        JMP END
EXIT    RTS             ;ALL DONE!
```

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by Matthew J.W. Ratcliff

Comp-U-Temp is a unique product with a special-purpose application. This hardware and software allows you to connect up to sixteen thermistors (electronic temperature sensors) to a single joystick port on your Atari. They can be monitored, displayed and printed. In versions 2.0 and 3.0, data may be logged to disk, too.

The sensors handle a range from −15 to +180 degrees Fahrenheit. This is an expensive "educational tool" for the home, but may be used in small businesses, where temperatures are a concern (computer rooms, greenhouses and chemistry classrooms).

The autoloading BASIC software first presents a menu for displaying temperatures, editing sensor information (names and alarm setpoints), or printing temperature data. Alarms may be set for high and low limits. You may change locations of sensors and alarm points, editing them after the original list is completed. If a channel is not defined, a default name of *NOT ASSIGNED* is set. All channels are monitored and displayed.

You reboot the computer to get back to the main menu and select a temperature-monitoring function. You may display only, or display and log data (to printer, disk, or both). Before displaying data, select a sample rate, from once every fifteen seconds to once every four hours.

The display (version 2.0 was reviewed) is a simple graphics mode 2 text screen. Each sensor's identification is shown adjacent to its most recent reading. A flag character is printed next to the reading, if high- or low-limits were exceeded. If any temperatures are out of range, the screen changes color and an alarm sounds. You can send each sample to the printer. Should you have version 2.0 or 3.0 for disk logging, each sample can be "appended" to a specified data file. The program places a maximum limit of 150 data samples total, if you're recording to disk.

My major complaint is with the disk filing. First, you must pay $20.00 extra for the disk logging version. The program disk may be copied for backup, but the BASIC programs are protected. They cannot be LISTed or LOADed; they are RUN only. So, if you need disk logging, it will cost you $20.00.

Worse, the program opens the data file for appending (rather than leaving it open, or using random access files). Each time another data point is to be recorded, every file sector (and its link) is read. When you're trying to record data at fixed 15-second intervals, you'll get anxious seeing data points being taken farther and farther apart as the file gets larger.

The limit of 150 data points is absurd, too. A good program would run a directory on your data disk, diagnose free disk space (from the FREE SECTORS line), and tell you how many data points you can read. It could estimate total data acquisition time by checking free disk space against your selected recording rate.

The software is cumbersome, overall. I see no point in protecting BASIC code; it's useless without the hardware. Sometimes one must be able to get data quickly and accurately. Temperatures are typically signals that vary slowly and do not require high sampling rates, but should be faster than every fifteen seconds. The sampling rate should be constant, too. The file append problem noted above is significant for faster sampling rates.

Comp-U-Temp is supposed to have approximately 1 degree resolution. I found my body temperature low by almost 3 degrees—a minor point, but if you want high-accuracy data, you won't get it here (a limitation of the paddle digitizer of the Atari, not the hardware).

To be fair, the **Comp-U-Temp** will give you access to temperature data in quantity, at a reasonable price. The documentation is brief and accurate, but provides no technical information on how the hardware works. I would like to see a less expensive, 2-channel version, along with time and temperature software (indoor and outdoor). I can see this used in smaller businesses, where temperature must be monitored on an "occasional" basis. With programming examples on how to compute temperatures from these "nonlinear" devices, there might be more applications in classrooms, as well.

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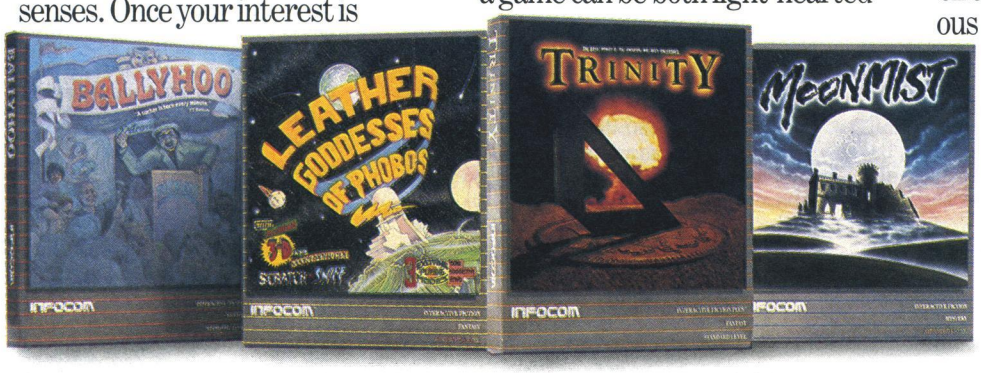

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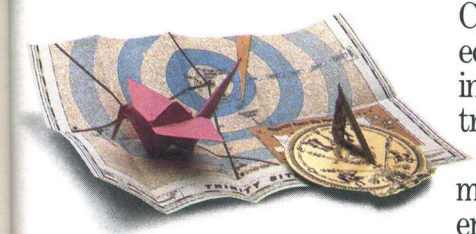

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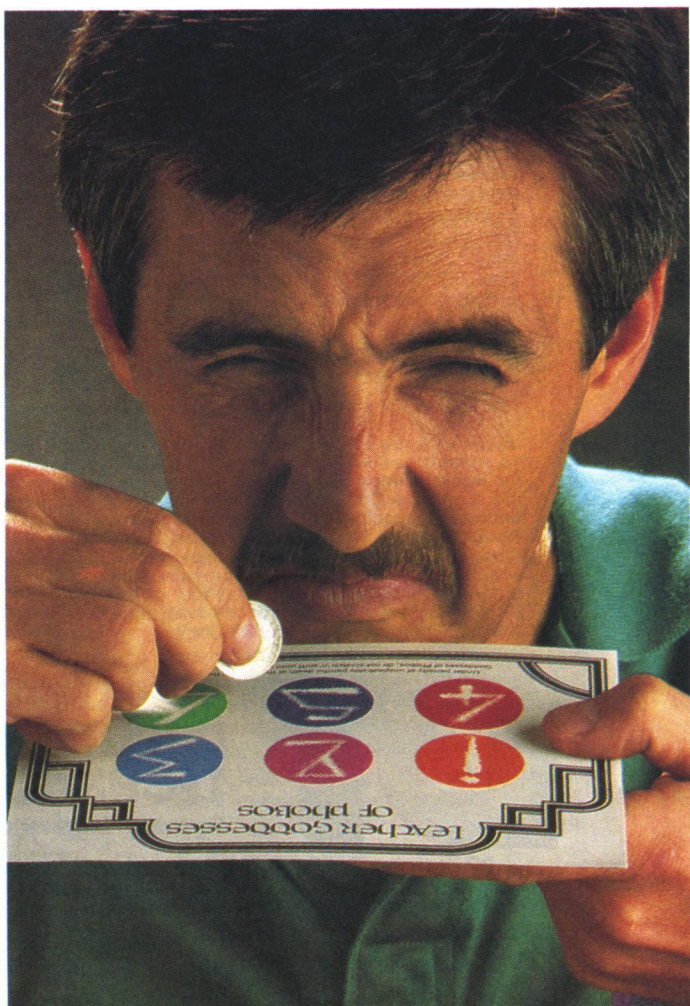

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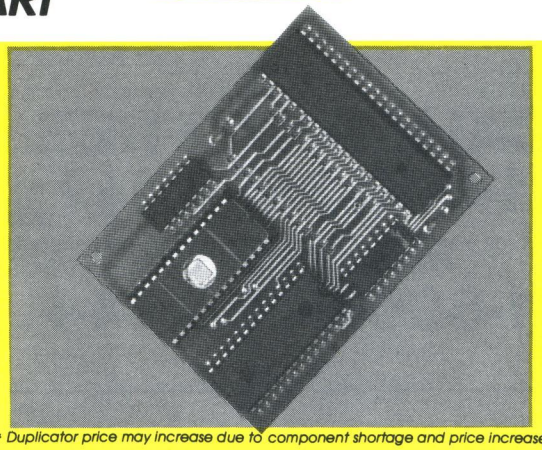

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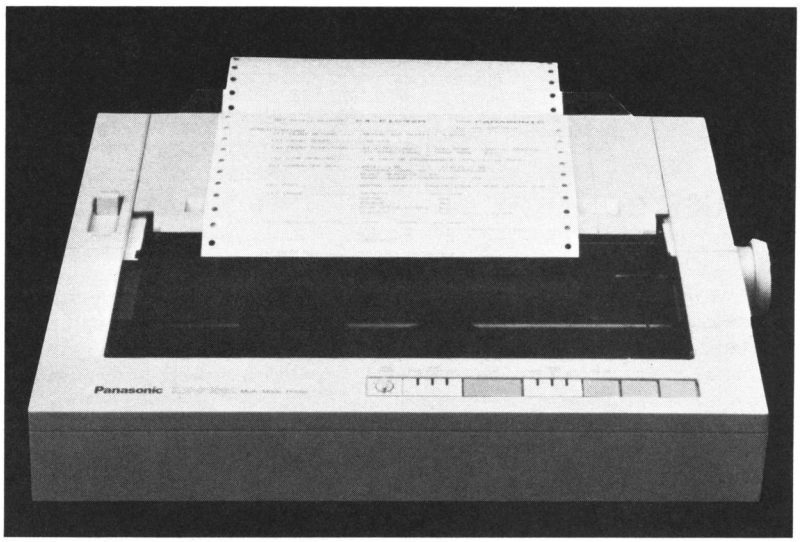
CIRCLE #121 ON READER SERVICE CARD

Panasonic KX-P1092



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by Pamela Rice Frank

When I finally reached the decision that —in order to increase my writing productivity and relieve my impatience—I had to have a faster printer, I followed the same steps which had led to the purchase of my Atari 800XL, 1050 drive, **AtariWriter** and 1027 printer. . .I started reading everything I could find on the subject. A *Consumer Reports* article on computers had convinced me Atari was definitely the right computer choice. A similar article in the June 1985 edition of the same magazine listed the Panasonic KX-P1091 (the model below the one reviewed here) as the dot-matrix printer with the best features and value for the price.

Although I wanted a printer that would give me graphics capabilities, my major concern was the appearance of the print. As a writer, I want my manuscripts to go out with as much in their favor as possible. I figured: the cleaner the copy, the better the chances.

Once I saw the near-letter-quality (NLQ) print on the Panasonic, I knew this was the printer I had to have. In this mode, the print appearance is "true" letter-quality, not near-letter quality. The font created by this printer is hard to distinguish from that produced by a typewriter or daisy-wheel printer.

I also found the Panasonic to be quiet, producing only a low-pitched hum while printing, rather than a shrill-sounding squeal.

Now, the only problem was the speed. The 1091 is rated the same 120 characters per second (CPS) as the Star Gemini 10X, but takes almost twice as long to print a page in NLQ, rated in that mode at only 19.3 CPS.

Then I discovered the Panasonic **KX-P1092**. Listing at $599.00, it retails for about $100.00 more than the 1091. It boasts a draft speed of 180 CPS, 112 CPS proportional type and 33 CPS in NLQ mode. The **KX-P1092** has the 10-inch carriage width, enough to accommodate business-sized envelopes—either individually or tractor-fed, since it includes those options.

Fan-folded, tractor-fed paper is a snap to load. (That was one thing I was able to do without the manual.) The standard tractor is also adjustable, meaning that the printer can take such off-size items as address labels, without the optional adjustable-width tractor some printers require.

The printer does a fine job on friction-fed individual sheets, although dip switch 2-3, the paper out detector, must be placed in the on (or inactive) position, in order to print the entire page.

Setting up the **KX-P1092** was a snap. The manual does an excellent job of explaining this procedure. Even though I'm definitely a nontechie, I was able to get my printer up and running after a quick glance at the instructions.

However, once it was up and running, I borrowed my friend's Star manual for help. Although the Panasonic manual has an index (something the Star manual lacks) the Star manual definitely offers an easier-to-understand format and explanations.

The Panasonic **KX-P1092** is a versatile IBM graphics and Epson-compatible printer. It supports 96 ASCII characters, 96 italic ASCII characters, 32 international characters (eleven countries), 64 block graphics and 132 IBM-PC special characters. Along with the above-mentioned proportional printing, it also includes pica, elite, italics, expanded, emphasized, (compressed) super/subscript, compressed, etc. However, these custom fonts can only be used in the draft mode. The **KX-P1092** has a membrane keyboard front panel across the left top of the printer. In addition to draft and NLQ modes, the standard italic, NLQ italic and proportional modes may also be selected, by an easy flick-of-a-switch method.

Since I hope to have an ST soon, I chose to use the dip-switch configuration necessary for the IBM mode, which is what the ST supports. With this configuration, I found the Epson RX-80 printer driver supported all **AtariWriter** commands. (I have not yet tracked down a **KX-P1092** driver, so I'm unsure how that works with it.) Also, with this setup, when I chose the Panasonic option in Broderbund's **The Print Shop**, pictures were printed with an extra line feed. Pictures are fine when the AXIOM ST option is used. (Atually, these dip switches are very simple to change, since they're located just inside the front cover. You don't even have to remove the ribbon cassette to reach them. I just hate messing around with that kind of thing.

Another feature that sold me on the Panasonic **KX-P1092** was the cassette ribbon. I hate fumbling with ribbon spools. The Panasonic's seamless fabric ribbons are rated at a service life of 3-million

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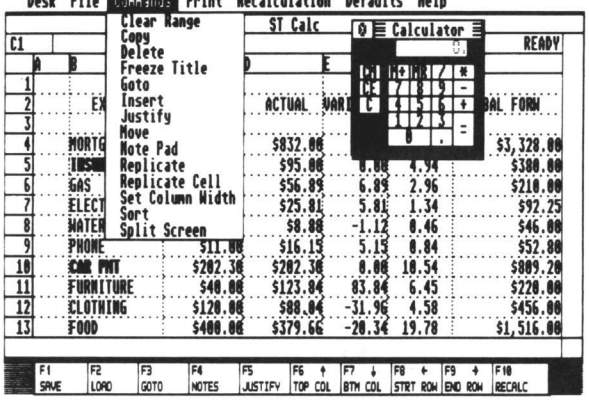

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characters. However, they do cost more than the standard typewriter ribbons used by the Star—around $9.95. This figures out to about 4 cents per double-spaced typewritten page, around twice the cost of a printed page on the Star.

The **KX-P1092** is a 9-wire dot-matrix printer. Panasonic lists the dot configuration at 12x18 in the NLQ mode. (I haven't counted; I'll take their word for it.) The Panasonic printers produce a squarer-shaped dot than others, which could account for the clean, crisp appearance of its NLQ letters.

The **KX-P1092** is a bidirectional (in draft and NLQ modes), logic-seeking printer. It prints unidirectionally in graphics mode.

I'm more than pleased with my **KX-P1092**—I love it! My 1027 has served me well for the last two years, doing the job when I wanted a printer to simply plug in and use, without contending with the interface, dip switches and control codes of third-party printers. But, if you're ready to expand your printing world. I can think of no better way to enter the fascinating world of printing versatility than with a Panasonic **KX-P1092**.

Pamela Rice Frank is a free-lance writer, as well as a part-time dispatcher for the local police. Co-editor of her Atari user group's newsletter and editor for JR's Computer's newsletter, she's owned her 800XL for two and a half years.

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CIRCLE #124 ON READER SERVICE CARD

M/L Editor

For use in machine language entry

by Clayton Walnum

M/L Editor provides an easy method to enter our machine language listings. It won't allow you to skip lines or enter bad data. For convenience, you may enter listings in multiple sittings. When you're through typing a listing with **M/L Editor**, you'll have a complete, runnable object file on your disk.

There is one hitch: it's for disk users only. My apologies to those with cassette systems.

Listing 1 is **M/L Editor**'s BASIC listing. Type it in and, when it's free of typos, save a copy to disk, then run it.

On a first run, you'll be asked if you're starting a new listing or continuing from a previously saved point. Press *S* to start, or *C* to continue.

You'll then be asked for a filename. If you're starting a new listing, type in the filename you want to save the program under, then press RETURN. If there's already a file by that name on the disk, you'll be asked if you wish to delete it. Press *Y* to delete the file, or *N* to enter a new filename.

If you're continuing a file, type in the name you gave the file when you started it. If the program can't find the file, you'll get an error message and be prompted for another filename. Otherwise, **M/L Editor** will calculate where you left off, then go on to the data entry screen.

Each machine language program in **ANALOG Computing** is represented by a list of BASIC data statements. Every line contains 16 bytes, plus a checksum. Only the numbers following the word *DATA* need be considered.

M/L Editor will display, at the top of the screen, the number of the line you're currently working on. As you go through the line, you'll be prompted for each entry. Simply type the number and press RETURN. If you press RETURN without a number, the default is the last value entered.

This feature provides a quick way to type in lines with repetitions of the same number. As an added convenience, the editor will not respond to the letter keys (except *Q*, for "quit"). You must either enter a number or press RETURN.

When you finish a line, **M/L Editor** will compare the entries' checksum with the magazine's checksum. If they match, the screen will clear, and you may go on to the next line.

If the checksums *don't* match, you'll hear a buzzing sound. The screen will turn red, and the cursor will be placed back at the first byte of data. Compare the magazine listing byte by byte with your entries. If a number's correct, press RETURN.

If you find an error, make the correction. When all data's valid, the screen will return to grey, and you'll be allowed begin the next line.

Make sure you leave your disk in the drive while typing. The data is saved continuously.

You may stop at any time (except when you have a red screen) by entering the letter *Q* for byte #1. The file will be closed, and the program will return you to BASIC. When you've completed a file, exit **M/L Editor** in the same way.

When you've finished typing a program, the file you've created will be ready to run. In most cases, it should be loaded from DOS via the L option. Some programs may have special loading instructions; be sure to check the program's article.

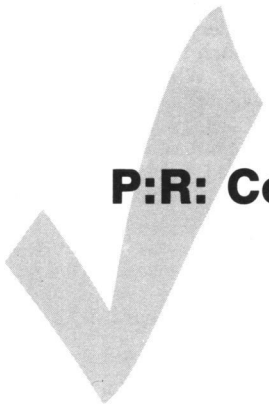
If you want the program to run automatically when you boot the disk, simply name the file AUTORUN.SYS (make sure you have DOS on the disk).

That's **M/L Editor**. Use it in good health.

The two-letter checksum code preceding the line numbers here is *not* a part of the BASIC program. For further information, see the *BASIC Editor II*, in issue 47.

Listing 1.
BASIC listing.

```
AZ 10 DIM BF(16),N$(4),A$(1),B$(1),F$(15)
   ,F1$(15)
LF 11 DIM MOD$(4)
BN 20 LINE=1000:RETRN=155:BACKSP=126:CHKS
   UM=0:EDIT=0
GO 30 GOSUB 450:POSITION 10,6:? "Start or
    Continue? ";:GOSUB 500:? CHR$(A)
ZG 40 POSITION 10,8:? "FILENAME";:INPUT F
   $:POKE 752,1:? " "
FE 50 IF LEN(F$)<3 THEN POSITION 20,10:?
   "  ";:GOTO 40
NF 60 IF F$(1,2)<>"D:" THEN F1$="D:":F1$(
   3)=F$:GOTO 80
KL 70 F1$=F$
TN 80 IF CHR$(A)="S" THEN 120
FD 90 TRAP 430:OPEN #2,4,0,F1$:TRAP 110
HQ 100 FOR X=1 TO 16:GET #2,A:NEXT X:LINE
   =LINE+10:GOTO 100
WM 110 CLOSE #2:OPEN #2,9,0,F1$:GOTO 170
VT 120 TRAP 160:OPEN #2,4,0,F1$:GOSUB 440
   :POSITION 10,10:? "FILE ALREADY EXISTS
   !!":POKE 752,0
ZU 130 POSITION 10,12:? "ERASE IT? ";:GOS
   UB 500:POKE 752,1:? CHR$(A)
VH 140 IF CHR$(A)="N" OR CHR$(A)="n" THEN
    CLOSE #2:GOTO 30
QG 150 IF CHR$(A)<>"Y" AND CHR$(A)<>"y" T
   HEN 130
BH 160 CLOSE #2:OPEN #2,8,0,F1$
IE 170 GOSUB 450:POSITION 10,1:? "NOW ON
   LINE: ";LINE:CHKSUM=0
GH 180 L1=3:FOR X=1 TO 16:POSITION 13*(X<
   10)+12*(X>9),X+2:POKE 752,0:? "BYTE #"
   ;X;": ";:GOSUB 310
KH 190 IF EDIT AND L=0 THEN BYTE=BF(X):GO
   TO 210
FY 200 BYTE=VAL(N$)
OZ 201 MOD$=N$
BU 210 POSITION 22,X+2:? BYTE;"  "
YZ 220 BF(X)=BYTE:CHKSUM=CHKSUM+BYTE*X:IF
    CHKSUM>9999 THEN CHKSUM=CHKSUM-10000
MS 230 NEXT X:CHKSUM=CHKSUM+LINE:IF CHKSU
   M>9999 THEN CHKSUM=CHKSUM-10000
IG 240 POSITION 12,X+2:POKE 752,0:? "CHEC
   KSUM: ";:L1=4:GOSUB 310
EW 250 IF EDIT AND L=0 THEN 270
QM 260 C=VAL(N$)
SY 270 POSITION 22,X+2:? C;"   "
IL 280 IF C=CHKSUM THEN 300
DI 290 GOSUB 440:EDIT=1:CHKSUM=0:GOTO 180
LW 300 FOR X=1 TO 16:PUT #2,BF(X):NEXT X:
   LINE=LINE+10:EDIT=0:GOTO 170
FV 310 L=0
LG 320 GOSUB 500:IF A=ASC("Q") AND X=1 AN
   D  NOT EDIT THEN 420
PO 330 IF A<>RETRN AND A<>BACKSP AND (A<4
   8 OR A>57) THEN 320
DX 331 IF A=RETRN AND N$="" THEN N$=MOD$
TD 335 IF A=RETRN AND L=0 AND X>1 THEN 35
   0
JR 340 IF ((A=RETRN AND  NOT EDIT) OR A=B
   ACKSP) AND L=0 THEN 320
DW 350 IF A=RETRN THEN POKE 752,1:? " ":R
   ETURN
GG 360 IF A<>BACKSP THEN 400
SA 370 IF L>1 THEN N$=N$(1,L-1):GOTO 390
AS 380 N$=""
RE 390 ? CHR$(BACKSP);:L=L-1:GOTO 320
BB 400 L=L+1:IF L>L1 THEN A=RETRN:GOTO 35
   0
WX 410 N$(L)=CHR$(A):? CHR$(A);:GOTO 320
KN 420 GRAPHICS 0:END
YT 430 GOSUB 440:POSITION 10,10:? "NO SUC
   H FILE!":FOR X=1 TO 1000:NEXT X:CLOSE
   #2:GOTO 30
FD 440 POKE 710,48:SOUND 0,100,12,8:FOR X
   =1 TO 50:NEXT X:SOUND 0,0,0,0:RETURN
MY 450 GRAPHICS 23:POKE 16,112:POKE 53774
   ,112:POKE 559,0:POKE 710,4
XR 460 DL=PEEK(560)+256*PEEK(561)+4:POKE
   DL-1,70:POKE DL+2,6
HW 470 FOR X=3 TO 39 STEP 2:POKE DL+X,2:N
   EXT X:FOR X=4 TO 40 STEP 2:POKE DL+X,0
   :NEXT X
ZW 480 POKE DL+41,65:POKE DL+42,PEEK(560)
   :POKE DL+43,PEEK(561):POKE 87,0
AC 490 POSITION 2,0:? "analog ml editor":
   POKE 559,34:RETURN
WZ 500 OPEN #1,4,0,"K:":GET #1,A:CLOSE #1
   :RETURN
```



P:R: Connection

ICD INC.
1220 Rock Street
Rockford, IL 61101-1437
(815) 968-2228
$79.00 P:R: Connection
$15.00 Centronics printer cable
$15.00 RS232 modem cable

by Matthew J.W. Ratcliff

The **P:R: Connection** (we'll call it **PRC** hereafter) is the best interface produced for Atari computers since the 850. The Atari 850 interface allowed you to connect a Centronics interface printer and up to four RS232 devices to your Atari. Most people didn't need all four—one or two maybe, but not four.

The 850 interface has been scarce for the past couple of years. There have been affordable printer interfaces on the market for Ataris in the $40.00 to $80.00 price range, but there was no reliable R: interface for standard RS232 devices.

A techie note: the **PRC** is remarkable. It contains two chips for buffering RS232 lines. The rest of the box is made up of capacitors, resistors and one square custom chip from Rockwell International. That little chip has a microprocessor, ROM, RAM and I/O ports for all the interface ports in the box. It's truly a technical wonder!

The **PRC** consists of a printer interface, P:, and two RS232 ports, R1: and R2:. The first RS232 port supports all the necessary handshaking lines for complete modem control. The second does not include all the control lines, but is still quite usable. (Both implementations are virtually identical to those of the 850.) The printer and modem cables available from ICD are solidly built, a comfortable length of about 6 feet.

The **PRC** box itself is small, about 5¼x 3¼x1", so it won't take up much real estate on your desk. The serial bus cable and an extra bus connector for daisy chaining are on one side, with the three interfaces on the opposide side. The extra bus connector is a nice touch. Most other "affordable interfaces" don't have an extra bus connector, to save on the production costs. Such devices become a "dead end" in your daisy chain. If you have more than one such dead-end device (XM301, 410 recorder, printer interface, etc.), cable juggling will become a real nuisance.

You will find no power switch or power supply for the **PRC**. Since it uses custom low-power circuitry, it can get its power from your computer. This will pose a minor problem for 1200XL owners, since that computer has a "current limit" resistor on the 5-volt supply line. The manual explains (in appendix E) how to replace this resistor with a jumper. If you have a little soldering experience, this is easy to do yourself. Otherwise, a "hardware hacker" friend—or just about any computer center—could do it for you with the information provided in the manual.

My first test of the **PRC** was to replace the old faithful 850. The 850's cables for the 825 printer, Hayes modem and 520ST connection were hooked to the **PRC**. I fired up the printer and talked to it, with no problems from any of my software. I hooked up the Gemini 10X and ran some **Print Shop** graphics dumps to it, without a hitch. I booted up my favorite version of Amodem Plus, and it worked the first time, every time.

Next, I set up Rat*Term in the capture mode (a modem program I wrote ages ago and never finished, but it does support R2: and 9600 baud). I booted up the 520ST with **ST-Term** by Matthew Singer and uploaded a text file. The **PRC** had no problem accepting the data at 9600 baud.

Just to get picky, I hooked up the 1020 printer at the same time—it also responds as a P: device. With the 1020 off and the 825 on, my LPRINT statements printed flawlessly. Next, I powered down the 825 and put the 1020 on-line. The LPRINT statements went to the 1020 with no problem. I found that, with both printers on at the same time, only the 1020 would respond.

There's also an internal switch for "auto line feed," most printers can perform. This switch gives you that feature at the **PRC**, should you have an older printer that doesn't support it. This auto-line-feed feature is a nice touch for ST owners who'll be swapping the same printer between the two systems. You can just set the auto-line-feed jumper in the **PRC** and forget about fussing with the line-feed dip switch on the printer itself. (A word to the wise: never swap your printer between two computers with *any* power on. I did this while testing the **PRC**—and zapped the Gemini *and* the ST. The Gemini was repaired in short order, but the chip to repair the ST was harder to find and replace.) It would be a good idea to get a Centronics switch box if you plan to do this frequently.

ICD has paid great attention to detail here, and has produced a device extremely compatible to the 850. My only minor (very minor) complaint is that the switches, along with a power switch, should have been made available at the side of the box. For example, switching between the old faithful 825 printer and the Gemini on occasion, I need a convenient way to handle the auto-line-feed control.

Some software may not be compatible

with the **PRC**, because its program makes direct calls to the SIO, bypassing the traditional CIO entries. For software that does cause problems, ICD provides a file called PRC.SYS. It is an "850 translator" that should solve any problems (say, with the newer version of **HomeTerm**).

If you're thinking about stepping up from an 835 or 1030 to a standard interface 300/1200 (or 2400) modem, you'll be pleased with a couple other files on the disk provided by ICD. The immensely popular *1030 Express* terminal program is provided as the new *850 Express*. And CompuServe users will be happy to know that *TSCOPE* has been provided on this disk as an updated *RSCOPE*. If you move up to a new modem when you get the **PRC**, you have excellent public domain terminal software to put you on-line right away!

The manual does an excellent job of describing the XIO commands which control the R: ports. I found it much more readable than the old 850 interface manual. If you want to make your own interface cables, the documentation provides the data. For the advanced user, ICD even supplies **PRC**'s SIO commands and a complete source listing of its R: handler source code.

Eons ago, the 850 interface provided the *standard* interfacing we needed for the 8-bit Atari computers, at a pretty hefty price (I paid as much for the interface as I did for my printer). When the 850's price finally came down, it was virtually extinct. At a very, very affordable $69.95, the **PRC** gives you all the standard interfacing features you'll ever need. Buying standard interface devices such as Centronics printers and RS232 modems, your peripherals may then be used on other computers, such as the 520ST. The **P:R: Connection** is my pick for Atari product of the year. I highly recommend it if you still have any unmet interfacing needs.

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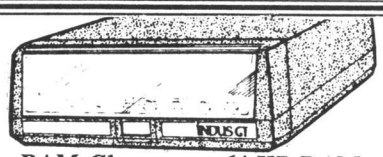

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CIRCLE #127 ON READER SERVICE CARD

ST-LOG

THE ATARI ST OPERATOR'S MAGAZINE

NOVEMBER 1986 ISSUE 8

THIS ISSUE:

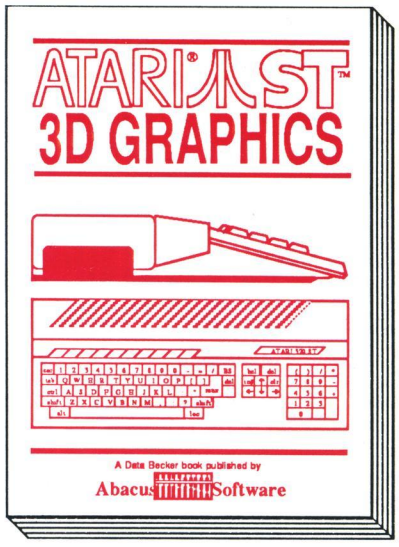
Alert boxes
ST status report
C compiler reviews

One good book...

deserves another...

and another... and another...

and another... and another... and another...



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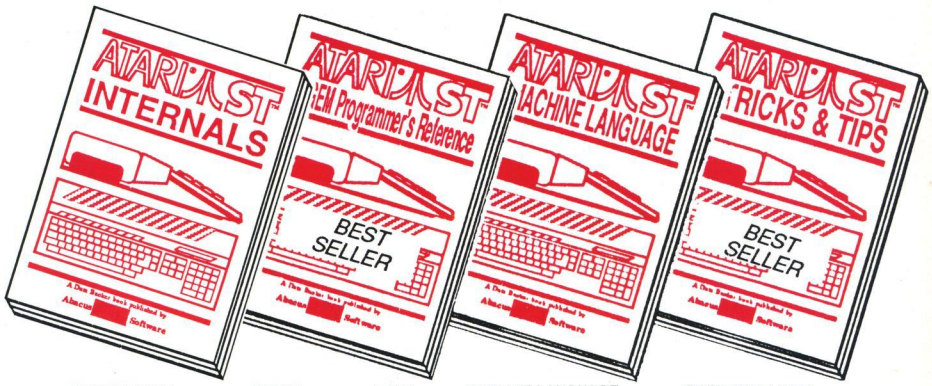

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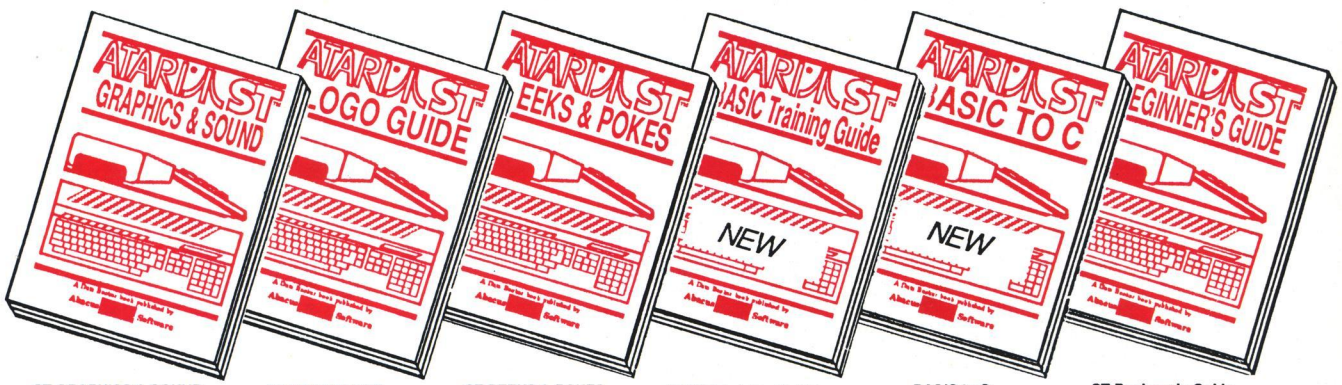

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THE ATARI ST OPERATOR'S MAGAZINE

ST-LOG

ISSUE 8
NOVEMBER 1986

FEATURES

ST DISK BONUS PROGRAM
Stock Performance Tracker . . . . . James Luczak 49ST
Track up to 50 stocks, with as many as 250 quotes each.

Status report . . . . . D.F. Scott 51ST
Atari's plans—for the ST line and beyond.

Printer graphics tutor . . . . . Matthew J.W. Ratcliff 66ST
Bit-image graphics are within your grasp with this tutorial.

Alert boxes from ST BASIC . . . . . Matheu Spolin 82ST
The *how-to*s for getting those message boxes into your programs.

REVIEWS

Megamax C (Megamax, Inc.)
and Mark Williams C (Mark Williams Co.) . . . Douglas Weir 75ST
Two impressive C compilers are examined and compared.

Games for your ST . . . . . David Plotkin 79ST
Monkey Business and **Delta Patrol** (The Other Valley Software), **Major Motion** and **Time Bandit** (MichTron) are scrutinized.

***ST-Log** readers should also note that there is a review of Infocom's **Trinity** at the end of **Panak strikes!** in our regular pages.*

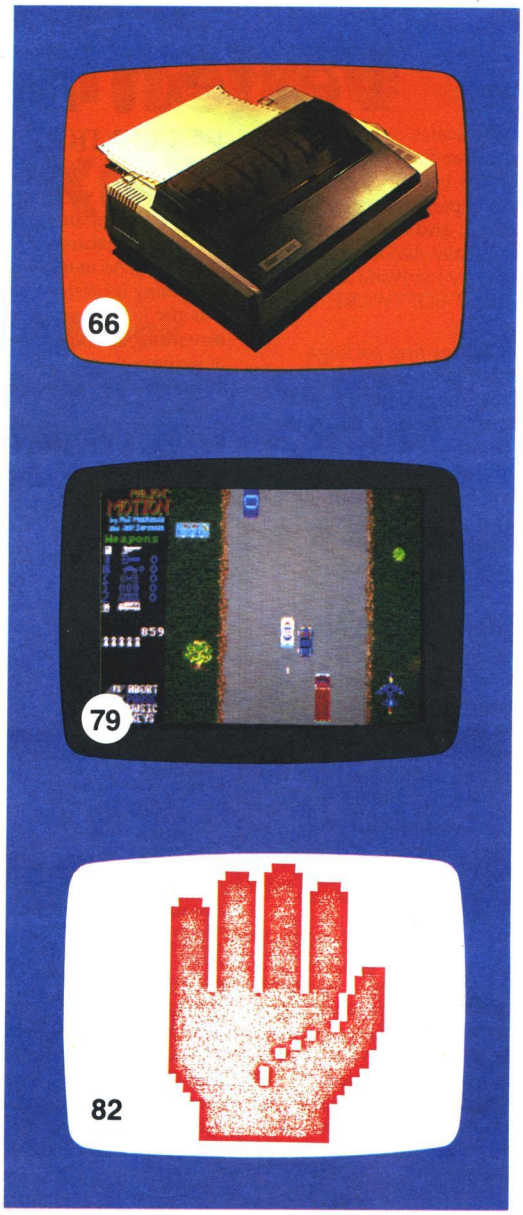
COLUMNS

C-manship . . . . . Clayton Walnum 57ST

Ian's Quest . . . . . Ian Chadwick 61ST
Ian is in the market for entertainment software—and finds it's no game.

ST news 65ST

ST index to advertisers 86ST



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by James Luczak

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Jim Luczak maintains and operates electronic telephone switching and processing equipment. He's been writing computer programs since 1979. He bought his first Atari in 1980, and has written programs in BASIC, C, LOGO, FORTH, Action!, and 6502 assembly. He enjoys writing dedicated database programs.

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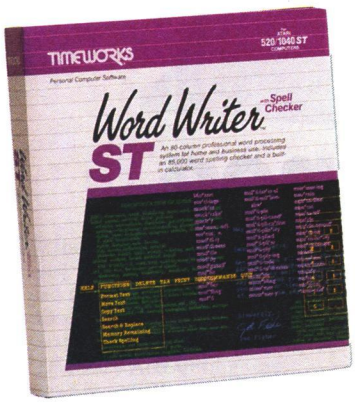

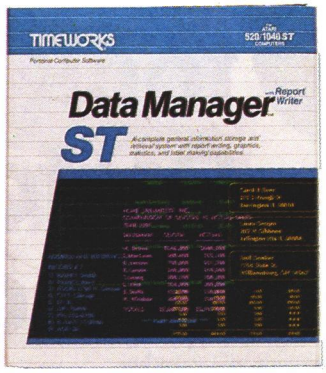

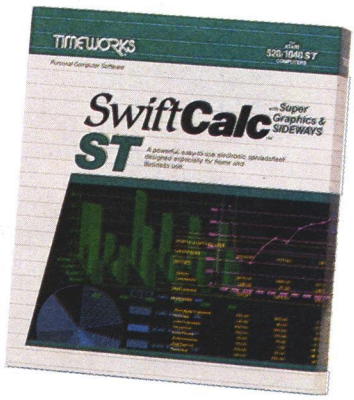

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Status report
ST SECTION

Just how is Atari's future (and that of the ST) shaping up?

by D.F. Scott

This article explores issues vital to the future of Atari Corp. Among our sources are: Michael Katz, Executive Vice-President in Charge of Entertainment Electronics; Leonard Tramiel, Vice-President in Charge of Software; Shiraz Shivji, chief developer of the "blitter" chip for the ST; and Jim Tittsler, developer of the ST's IBM PC-compatibility unit. Other sources have asked to remain confidential and not be directly quoted.

The material here is the ST-oriented portion of a complete overview of Atari Corp.'s plans and possibilities. We suggest, to obtain the comprehensive picture, readers also refer to the 8-bit section of the report, on page 13. The future of Atari is dependent upon all of its products.

First things first . . . the TTs are coming.

A new machine is in the works, and it's shrouded in misinformation. From Atari's own corporate heads, with the inconsistencies ironed out, here's what we're free to assume: the CPU of the TT (Thirty-two/Thirty-two) will be the 68020, supporting a 68881 math co-processor. One obvious benefit from the use of these chips: full communicability with the ST. The CPU will *not* be National Semiconductor's 32000, as previously thought.

The operating system will be UNIX V, the full multi-user version by AT&T. Current implementations of this multitasking system give programs or tasks an operating priority alongside physical devices, as if each program were a "virtual device" in itself. They also feature exclusive access to a "C-shell," or a type of runtime package which handles C-language routines in a manner more familiar to GEM users.

The TT exists now. Prototype units are running in the labs. Several Atari sources are describing the TT as "VAX-in-a-box." It's obvious someone high up at Atari wants employees and the media to promote the product in that manner.

One Atari source compares the TT to products from Apollo, a company based in Chelmsford, Massachusetts. Apollo now manufactures graphics workstations based on the 68020. These, like the TT, have a 2 Mb RAM base. Using 68881 floating-point co-processors, Apollo's Domain workstations are clocked at 16 MHz. A color raster display of 1280x1024 pixels chooses from a palette of *16 million colors* in analog representation. It can plot 100,000 floating-point-transformed 3-D vectors per second, with an area-fill rate of 125-million pixels per second. We're no longer in the Amiga's ballpark.

Atari's projected TT price tag is from $1,200.00 to $3,000.00. But Atari's marketing department is stalling. Apollo is a relatively small company, with small sales figures, on the Atari scale. By one estimate, if Atari scores nearly as well with the TT as Apollo has with Domain, Atari could sell 50,000 TTs annually, an amount considered "disastrous" by Atari standards.

Atari is currently considering several final packages for the TT. The leading candidate would use the ST as an input/output device, linked through the TT's Direct Memory Access port. It would then be, in a sense, an ST upgrade (yet another one, as we shall see). But shipping the TT in this form alone may confine TT owners to a subset of ST owners, limiting the machine's market potential.

Atari also has to consider the question of user support. It disconnected its 800 phone number years ago, so it relies solely upon computer specialty stores for user service and education. Where department stores are concerned, Atari relies on the owner's manual for user support. How then can a corporation market a machine, one it claims will outperform two DEC VAX 760 mainframes, with nothing more from the manufacturer than a 90-day warranty?

There are education and support centers in chain stores, known as Value-Added Resellers. VARs haven't considered Atari products for an instant. The most likely reason isn't the mass-market name, but the need for a big value to *add to* in order to resell. In other words, "Power without the Price" is powerless to VARs, and VARs are the Apollo domain. Direct competition is most likely out.

So the TT's domain may be the specialty store, where a corporation's systems analyst or consultant may not expect to find a 32-bit UNIX workstation. At the specialty store, it could be sold in a variety of package deals.

Here's where the machine may find its saving grace: it's a *multi-user* workstation. Buyers would purchase more than one ST for terminals, maybe even enough to outfit an entire office.

On the bad side, specialty stores currently committed to Atari might not be able to afford to keep enough STs in stock for that kind of low-price, high-quantity buying.

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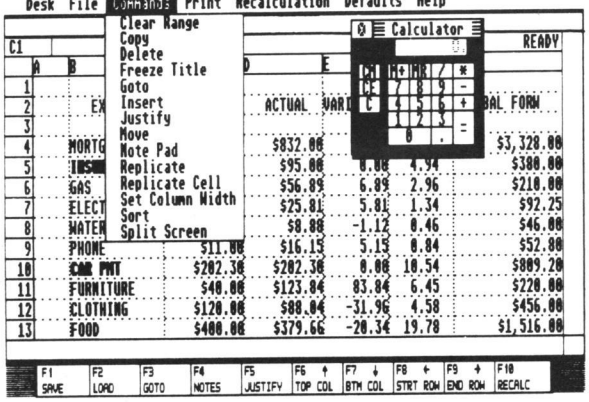

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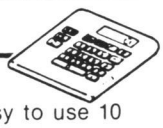

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However, if the price were low enough, (and it should be), a company placing a large order might just find the patience to wait a mere couple of weeks.

The TT also interferes with Atari's plans for the ST. If a more capable ST than the 1040 were to emerge—say a 2080—that machine would go to the specialty stores, and the 1040 would be moved to the mass-market arena. But the 520 is a smart enough terminal. With half a megabyte and a 68000 CPU, "genius terminal" is a more fitting term. Unfortunately, Atari has handed the 520 solely to the mass-market; and the corporation consultant is unlikely to go to a department store for a set of office terminals.

Atari may have to go back on its promise to mass-merchants and market the 520 in specialty stores once again. Or it may rely on private wholesale distributors to sell the 520 to specialty dealers. The idea has not yet been discussed publicly, but in this reporter's opinion, Atari could produce a downgraded 520 *terminal-only* machine as part of a TT package deal. This way, the TT may—or may not—connect to the ST.

Certainly the TT is too much computer for checkbook-balancing and recipe-filing. It would play the meanest game of **Star Raiders** the galaxy has ever known. But Atari is afraid the buyer may stare at this colossal product of progress and ask, "So, what's it for?"

Consider the following: the Macintosh has practically created the desktop publishing industry. The ST is giving birth to the home computer artist. I see a revolution in which the TT will be the catalyst: *desktop engineering*. The 32-bit mass-market micro may give birth to the free-lance engineer. Optimistically speaking, the whole industry may flip over forward—and the creative, tinkering programming geniuses may finally have their turn in space.

As one Atari spokesman put it, "this is the future."

ST Hardware.

This is the present. If ever there's to be an Atari star, the ST is bound to be it. At every major show, wherever there's an ST, there are hundreds of awestruck people in front of it. The future right hand of the TT is currently breaking ground quite well on its own.

Atari itself, though, sees the ST (Sixteen/Thirty-two) in a different light: as an incomplete machine. Its other half is still in the lab. The promised "blitter" enhancement, for instance—(the chip that can move blocks of memory, virtually at once) is still being tested. GDOS, the portion of the ST's Virtual Device Interface currently missing (the part that would allow the machine to perform object-oriented graphics tasks) is promised in program form for the near future, until its ROM version becomes Expansion #1. Atari admits that GEMDOS, which controls computer input/output, is bug-ridden, but Digital Research, its author, may not be willing to debug the system. Atari may perform this task itself—which makes for ROM Expansion #2. Finally, when the blitter chip arrives, the entire screen graphics system will change. Output may appear similar, but will be plotted much faster. This makes for ROM Expansion #3.

We can expect GDOS soon, perhaps by press time. The new GEMDOS is slated for January. The blitter may not be ready that soon. Until Atari can finally say the ST is a complete machine, third-party software development may be put on hold.

The blitter chip was originally billed as an enhancement to the 1040, but Shiraz Shivji tells us it's now being worked into the 520's architecture. No decision has been made concerning where to seat the chip in the 520 (the 1040 should have a slot for it) but, as Shivji points out, "It's not going to be through the user port. Our intent is to be able to upgrade all the 520s that are out in the field."

"The way this co-processor works," says Shivji, "is that it sits on the bus until it's invoked. Obviously, you'll need the software to invoke it." Which may mean it waits for GDOS.

Shivji also stated that the new chip will not be as much of a graphics enhancement as some have been led to believe: "Let me make this perfectly clear: It will *not* give you greater resolution. It will *not* give you more colors. It gives you a lot more speed. I also need to add that it is a *transformation engine* that you can use, not just for display. With the blit operation—block move—you can do the screen, or you can use it for other areas of memory, other applications not involving the screen."

Lab tests are currently showing an average speed increase in the ST by a factor of five with the blitter chip. While it's Atari's latest response to the Amiga, the chip is also reminiscent of technology present in the Atari 8-bit product line, which programmers have grown to respect.

As we've noted, Atari is venturing deep into IBM territory, hoping to carve a niche for itself in the "business," or "serious" market. Atari has no emulator for the IBM corporate image, but that image is either heralded greatly or criticized greatly, and many PC-clone buyers made their purchase just to spite Big Blue. Anyway, Atari

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is now targeting the market whose buying decisions seem to rely upon reports of what IBM corporate executives ate for breakfast.

Thus the PC-compatibility attachment to the ST—as yet unnamed, so I'll just call it the Big-Blue Box (or 3B, for short). Its developer, Atari's Jim Tittsler, tells us it contains the expected 8088 CPU, which can use the ST's 68000 as a co-processor if necessary, and will support an 8087 math co-processor. Using the ST's I/O (which is reportedly being revised in the new GEMDOS), it hogs the space of the full ST monitor. In other words, the models currently being tested override the ST, though future software enhancements may allow a PC task to run in a separate window of ST GEM, while the ST is doing something else. No word yet whether 3B will have its own RAM, but it probably won't have its own 5¼-inch disk drive—instead, slots will be available for 5¼-inchers, and the current SF354s and 314s may be used for 3½-inch IBM-formatted software.

According to Tittsler, the prototypes are currently allowing upgrades of PC files to ST-legible files, most notably from Lotus 1-2-3 to **VIP Professional**, and from dBase III to **dBMan**. The speed at which some PC applications are run may be faster or slower on the 3B than on the PC, unless an 8087—or perhaps the acclaimed V20 chip—is used.

While downplaying his own product, Tittsler describes its intended market: "Mostly we see this as a bridge to let people take advantage of their older software, because you can get better performance with software that's written directly for the 68000... If (people) have spent a large portion of their lives learning how to effectively use Multiplan or something, they don't want that training to be useless."

Tittsler, further downplaying his product, calls it "just an add-on appendage... It's intended to give the people who have STs—or who want to take advantage of the newer technology of an ST—the ability to still run older-generation software." He admits it's possible, but not likely, that Atari may write software specifically for the 3B.

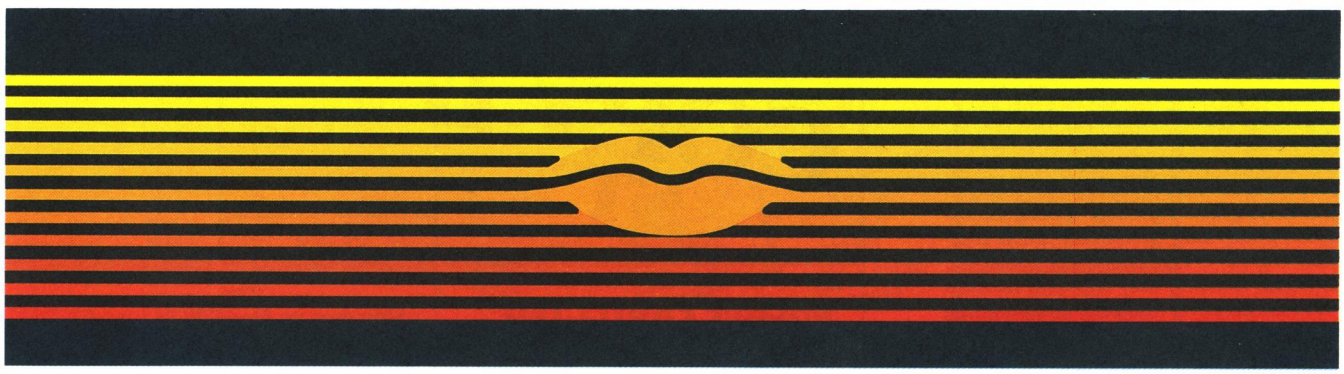
So it's obvious that Atari is seeking the buyer who was at first taken aback by the ST's dazzling appearance, the one who, after seeing **Neo-Chrome**, **1st Word**, and **dB Master One**, asked, "Yeah, but what does it do? Can it run Lotus?" The company is also attempting to sway the person who invested thousands in 8086/8088-based software into finally taking the step to use of the next-generation computer.

Atari hopes to speed up progress in plugging the numerous small holes in the ST. But, in reviewing this report, one may get the impression that Atari wants to *slow down* progress just long enough to profit a bit more from its spoils. It's easy to see why. It would be a major blunder for Atari to cast the yearling ST into the realm of obsolescence by introducing a 32000-chip-based system for about the same price.

So the TT will run on a 68020, and thus become a family member, paired with it like a brother. The box I call the 3B is Atari's attempt to profit from the fact that IBM is viewed as the axis upon which the computer world revolves. At its surface are the clones, held there by the centrifugal force of repulsion from the corporate axis. There's still a profit to be made from the older generation—until the ST's earthquakes settle—and 68000/68020-based machines constitute the new axis.

ST Software.

In the process of turning heads, Atari



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Corp. has acquired some frustrated ST owners. The library of ST software is growing steadily, but is still not as profuse, or as well-backed, as the older generation of software. The ST owner's frustration occurs while awaiting a breakthrough. It's *here* we see Atari trying to speed up progress, to make Atari into Big Grey.

To that effect, there's good news: Microsoft is joining the ST league. It is working with Atari to make a GEM-based version of the blockbuster program **Word** for the ST, to be called either **Word** or **Write**. One source says the program should resemble **Word** for the Macintosh. Another states he feels Microsoft is unsure what the program should resemble, since the company must undergo the humiliating task of adapting **Word** to GEM, a product of rival Digital Research. A superior **Word** using GEM may jeopardize the future success of the version which employs Microsoft's own **Windows**.

Word, both for the Mac and the PC, includes extended laser-printer support, beyond mere dot-matrix. It's considered by many to be a tool for desktop publishing, an industry made possible (in large part) by the Macintosh. Of desktop publishing, Leonard Tramiel says, "That phrase is so overused that it no longer means anything."

"As far as being able to support a laser printer is concerned," the Vice-President continues, "there's half-a-dozen laser printers out there, which emulate so many different (dot-matrix) printers that any product can support laser power. . . So virtually every word processor at this point supports laser printers; it's actually difficult to write one that doesn't."

Beyond the emulation of dot-matrix printers, Tramiel is unsure that preprinting layout will be a feature of **Word**, saying, "I'd have to be clairvoyant to tell you." Contradicting other sources, Tramiel confirmed that Atari is working *with* Microsoft to develop a superior product.

Superior or mediocre, Atari has scored a victory in acquiring Microsoft's assistance. There's only one microcomputer I can name, to date, which has thrived without being somehow shaped by the hand of Bill Gates at Microsoft, and it is the ST. That should be an indication of the machine's strength—it has independence, not "compatibility."

It's not indication enough, though, for Lotus Development Corp. (1-2-3, Jazz) and Ashton-Tate (dBase III, Framework, MultiMate), the two other largest software manufacturers. Both, according to one source at Atari, are ready and willing to write versions of their best for the ST, provided the magic number has been reached: 1,000,000. Once a million STs have been sold, and a huge worldwide customer base established, we'll see the world's best-selling programs running on an Atari.

Then, it will be no contest. All the buyer's excuses will be gone. The ST will run the best, and run them better and faster than anything else. If there's something that wouldn't otherwise run, the 3B box or DataPacific's **MacCartridge** (which Atari is staying clear of, due to possible legal action by Apple) will make it work. But we need a million out there, and that won't be easy.

Where do we stand in the meantime? We have Microsoft on our side now. **Word** will be first; and, of course, there will be MS-DOS for the 3B box. Without the box, the ST will run **dBMan** and **VIP Professional**, which generate results so close to their IBM-league work-alikes that Jim Tittsler's men can successfully convert files from one program to the other—without any noticeable difference.

Atari admits the current version of **ST BASIC** is bug-ridden, perhaps even a mistake. Microsoft may remedy that situation, and indications from Atari are that, with the necessary money, we may see an MBasic interpreter for the ST.

With so many companies marketing utilities and programming languages for the ST, what could possibly be lacking? Atari's answer comes in two names: Lotus and Ashton-Tate. Atari would like to see those companies join the list of ST developers, for the sake of their names alone. After all, if the genuine items run on the ST, it *must* be a solid machine (in the eyes of potential dealers). And that will be seen when there are a million STs "in the field."

So Atari is wondering how to sell a million, and here's where the "TT" comes into the picture. The TT will sell STs for "genius terminals." A small office complex could use (and afford) a TT system networking a half-dozen STs, giving the 16/32-bit machine an entirely new, broad-scope market.

Imagine a TT system with an ultra-high-resolution display. In one corner of the display, dBase III is sorting out metal parts. In another, **Word** shows a document detailing the cost of those parts. In a third, the IBM-emulation window is running a 3-D tally spreadsheet like **VP Planner**. In the ST window, there's a **Neo-Chrome** diagram of a part. Finally, in the center, the TT is rotating a 3-D cutaway image of the future shuttle booster rocket.

This type of technology is not just a possibility; if marketing comes to a decision soon, we may be seeing a TT/ST component system in retail outlets by late 1987. It could carve a new niche as the first 32-bit machine capable of running the familiar software of the 8/16-bit era.

This does pose a problem for **ANALOG Computing**: will this mean another schism in readership? We hope not!

But onward. . . if there's anyone Atari supporters feel threatened by, it's the potential dealer or buyer who publicly claims that the company responsible for **Asteroids** is incapable of manufacturing the TT—that game-playing and data-processing are two separate worlds, and ne'er the twain shall meet. By now, we're well acquainted with the person whose guilty conscience brings forth the statement that only kids play video games; adults are too busy doing *real* computing to notice. Too often creativity gets tossed aside in favor of "productivity." Still, as presented in Orwell's *1984*, the notion that some higher person is watching over our every move, passing judgment over our productivity, is a mistaken one—that is, unless we *are* captives of our paychecks.

Entertainment Electronics.

Atari's roots are in game machines, and that's nothing to be ashamed of. The creative genius who invents or programs a computer is the same genius who toys around with it. Still, the 8-bit Ataris have always had to be proven and fought for. It's as if the machines themselves were a *cause*, like unionization or the abolition of apartheid.

Atari began with game machines. The mind that will play for hours will, often, program in a creative way, will invent a *new* kind of wheel. Having its roots in the game market makes Atari Corp. no less a computer in the business world.

The current ST line is bringing Atari into the ring in the "real" world. It is creating a vital excitement in the computing community. And the "game machine" revenue feeds the growth of all Atari products.

Atari has some choices to make, directions to choose. But, if Jack Tramiel has proven anything, he's shown the world that Atari's options are wide open.

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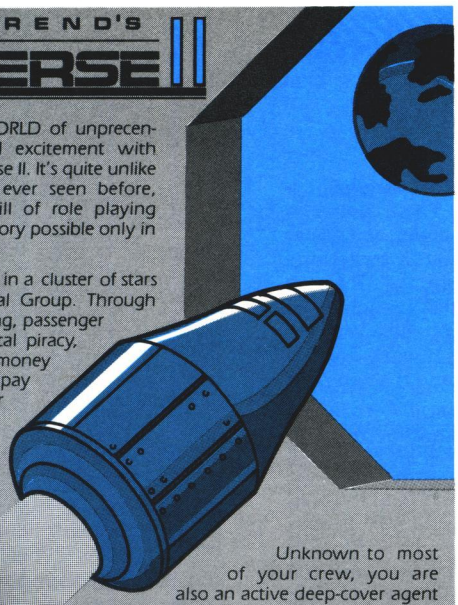

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WHAT IS ST-CHECK?

Most program listings in **ST-Log** are followed by a table of numbers appearing as DATA statements, called "ST CHECKSUM DATA." These numbers are to be used in conjunction with **ST-Check** (which appeared in **ANALOG Computing/ST-Log** issue 41.

ST-Check (written by Clayton Walnum) is designed to find and correct typing errors when readers are entering programs from the magazine. For those readers who would like copies of the article, you may send for back issue 41 ($4.00).

ANALOG Computing/ST-Log
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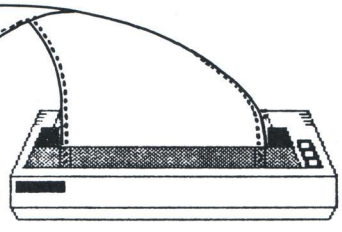

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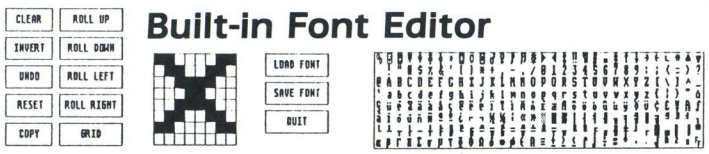

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CIRCLE #170 ON READER SERVICE CARD

C-MANSHIP

by Clayton Walnum

Everyone give a hearty cheer. This month we'll be finishing up the most grueling details of programming in C, so that next month we can start learning about GEM. It's been a long time coming, but you can't bake a cake until you've heated the oven, right?

Last month's program listing overflowed with new material. Consequently, we didn't have time to cover most of the program's details. So guess what the first item on the agenda is? If you have last month's listing, take it out. Otherwise, just read along; I'll try to make this as self-contained as possible.

Unfinished business.

At the top of the listing, beneath the block of defines, you'll see a function, fopen(), being declared as returning a pointer to type FILE. If you think back, you'll remember that any time a function is going to return something other than an integer, it must be declared. But what the heck is FILE, anyway? We've never discussed this data type, have we?

Actually, in a way, we have. Last month, we talked about structures—data types that are specifically tailored by the programmer. FILE is a structure defined in the stdio.h file, containing the data elements required to handle file I/O.

Wait a minute. That fopen() isn't *our* function. Except for the function calls, this guy is nowhere to be found in our program listing.

That's true. It's a library function. Now, one would think that, if whoever composed the stdio.h file went to all the trouble to set up the FILE structure, he would have at least gone to the extra effort to make fopen() "ready to go," by declaring it as returning a pointer to FILE and finishing the job.

For some strange reason, the version of stdio.h that comes with the Atari developer's kit doesn't include the declaration, so we must do it ourselves. If you have the Megamax compiler, however, you can delete this declaration from the program; they *did* award us the courtesy of finishing the job.

By the way, the sample listing we're discussing was developed using the Megamax-C development system. I included the function definition only to make the listing more compatible with the Atari development kit.

As for the file declaration for fclose(), you can ignore it. It was included in error and is unnecessary, since this function returns an integer, not a pointer to FILE.

A quick look at GEM.

Just beyond the file declaration for fopen(), there are declarations for a number of global arrays: work_in[], work_out[], contrl[], intin[], ptsin[], intout[], and ptsout[]. If you've looked at some of the C source code for various GEM programs in the public domain, or those published in magazines, you've noticed that these arrays are almost always present. In fact, you've probably seen some of them used in ST BASIC programs, as well.

All the above arrays have one thing in common: they provide GEM a place to store or retrieve information about the program. This information can then be easily manipulated by the programmer.

I know, I know. I told you we weren't going to be getting into GEM until next month. But we *are* going to learn a little about initilizing a GEM program, since the cursor control functions I used in last month's listing are found in the VDI portion of GEM.

What's VDI? GEM is made up of many libraries of functions, each of which is responsible for handling a certain portion of the system's activities. These libraries are

grouped into two major units, called AES (Application Environment Services) and VDI (Virtual Device Interface). The libraries making up the AES handle such things as windows, dialog boxes, menu bars and event processing. (An event is some action from the user, such as typing a letter or moving the mouse.) The VDI contains the subroutines to control the ST's graphics, as well as some mouse and cursor control functions.

Since GEM is capable of handling several programs at once (such as using a desk accessory with a word processor), there has to be a way of keeping one job separate from another. GEM tackles this by assigning each program and its associated device (in our case, the screen) a "workstation" which can then be referred to by an identifier known as a "handle." The first thing any GEM application must do is open a workstation.

Which brings us back to the arrays that started this discussion. When we open a workstation, we have to tell GEM how we want the system's attributes initialized. What color should the text be? And should it be shadowed? Or maybe bold? What style fill do we want? Solid? Checkered? All these attributes should be placed in the array work_in[] before we open the workstation, since that's where GEM is going to expect to find them.

We're not going to worry, at the moment, which elements of the array hold information for which attribute. We're just going to take it on faith that work_in[10] must be initialized to *2*, and the rest will be perfectly happy at *1*.

After we've set up the array, we tell GEM to open the workstation with the v_opnvwk[] call:

```
v_opnvwk(work_in,&handle,work_out);
```

The parameter work_in is the address of our array work_in[], which contains the attribute information we wish to pass to GEM. And &handle is the address where GEM should store the handle, the integer value that will allow us to refer to this program's workstation. In our sample program, it's the address of the variable handle, which is defined after the work_in[] and work_out[] arrays at the top of the listing. The parameter work_out is, of course, the address of our array work_out[].

When we open the workstation, GEM will load the work_out[] array with all the information a programmer needs about the workstation. For instance, work_out[12] will contain the number of hatch styles available, while work_out[13] will contain the number of colors that can be displayed at one time. We don't have to be concerned with this information now, but it is important that you understand why we need these two arrays.

You can see the mechanics of opening a workstation in the open_vwork() function of the program listing. Also, at the end of main(), notice the function call:

```
v_clsvwk(handle);
```

This closes the workstation to further output. The argument handle is the device handle passed to you by the v_opnvwk() call.

And a peek at VDI.

The remaining five arrays, contrl[], intin[], ptsin[], ptsout[] and intout[] are directly associated with the VDI. The first three are used to pass information to the VDI routines, while the last two provide a means for the VDI to return information to the program. These arrays are used by GEM for its own purposes; you need do nothing more than declare them at the beginning of your program. It's ironic that, although C is considered to be a lower-level language than BASIC, when manipulating the VDI from ST BASIC, you must deal with the VDI arrays yourself rather than leaving them to the system.

Moving along.

If you've spent the time to examine last month's program listing, you were probably wondering what was going on with the function call:

```
Cconws("FIRST NAME: ");
```

This function does nothing more than write a string to the screen. Why didn't I just use printf() and avoid all this confusion? It has to do with another discovery I made concerning Megamax-C. With Megamax, printf() won't print anything until it encounters a \n. This makes handling prompts tricky, if you want the user's input on the same line as the prompt. Resorting to Cconws() solved this problem.

Another new function call, fscanf(), was used in the sample program in the disk_file() function.

```
fscanf(p_file, "%d", &num_recs);
fscanf(p_file, "%s", recp->street);
```

This is similar to scanf() except it retrieves and formats information from a file, rather than from the keyboard. In fact, the only difference between the two calls is the addition of one argument, the pointer to the FILE structure. Otherwise, it contains the same conversion specifications as its cousin, followed by the addresses where the data should be stored. The first example above reads an integer from the file and places it in the integer variable num_recs. The second reads a string from the file and places it in the structure member street.

The opposite of fscanf() is fprintf(). In our sample listing, it's called within the function save_file() like this:

```
fprintf(p_file, "%d\n", num_recs);
fprintf(p_file, "%s\n", recp->city);
```

This function is almost identical to printf(), the only change being the extra argument, the pointer to the FILE structure.

In the first example, we're printing to the file the integer value stored in num_recs, followed by a newline. In the second, we're printing to the file the character string stored in the structure member city, also followed by a newline.

The VDI cursor stuff.

If you look at the functions screen() and pos_cur() in the program listing, you'll see the cursor control function calls I mentioned earlier. In order to take advantage of these functions, you must first make the call:

```
v_enter_cur(handle);
```

This gets you out of graphics mode and into text mode. In this function, as with all the following, handle is the workstation identifier that was returned to you by the v_opnvwk() call.

We can position the cursor anywhere on the screen by

passing the X,Y-coordinates to the function vs_curaddress():

```
vs_curaddress(handle,y,x);
```

Notice that the coordinates are passed in the opposite order of what you'd expect; that is, Y followed by X. Also, keep in mind that we're now in text mode. The cursor location is based on character positions, not raster coordinates. In medium-resolution text mode, the screen's size is interpreted as 80x24, whereas in graphics mode it's 640x200. Quite a difference!

Printer output.

I don't know if it's a difference between Megamax-C and the Atari development kit, or just plain bad luck, but I had an awful time getting printer output. I have a feeling the solution I incorporated isn't as elegant as it might be, but I had to settle for it under the pressure of time. So, with that disclaimer in mind . . .

Take a look at the function printer() in the sample listing. The first thing we have to do is check to see if the printer is on.

```
status = Cprnout(0);
```

The line above accomplishes this by sending a null character to the printer. If the printer times out, a *0* will be returned by the function. Another way to check the printer is with the function Cprnos() which returns a nonzero value if the printer is ready to receive:

```
status = Cprnos();
```

We then open a file to the list device:

```
p_file = fopen("LST:", "w");
```

After this call, p_file will contain a pointer to a structure of type FILE. The first argument passed to fopen() is the filename, in this case, the list device. The second parameter tells the function the attributes we want the file to have. There are six possibilities:

r. . .read only
w. . .create for writing
a. . .append (write at end of file)
r+. . .update (read and write)
w+. . .create for update
a+. . .random read or write

If the open was not successful, the function will return a null pointer.

Now comes the tricky part. The file we just opened is a disk file. We want to send the output to the printer. The pointer p_file is now pointing to our FILE structure. The fifth member of this structure, _fd, is a file descriptor. If we replace the value in _fd with a *3*, we'll fool the system into sending the output to the printer:

```
p_file->_fd = 3;
```

Now, we can output the data using fprintf(). When we're done, we close the file:

```
fclose(p_file);
```

The function fclose() will return a *0* if successful, or an EOF *(-1)* if an error is encountered.

Finally, since we ended up opening a disk file, we want to get rid of the evidence:

```
unlink("LST:");
```

The function unlink() will remove the directory entry for the filename passed. It returns a *0* if successful, or a *-1* if an error is encountered.

The problem with the above method of obtaining printer output is that a disk must be present in the drive.

Odds and ends.

That covers all the material from last month's sample program. We have a final task to complete, before we can move on to GEM: touching on a few details of the C language we haven't yet covered.

What do you make of the following line?

```
z = (x < 4) ? x : y;
```

Believe it or not, this is nothing more than a shortcut version of:

```
if (x < 4)
   z = x;
else
   z = y;
```

The ?: is a conditional operator that requires three operands. The first operand (within the parentheses) is the expression that's tested. If it's true, the statement yields the evaluation of the second operand (between the *?* and *:*). If the first expression is false, the statement yields the evaluation of the third operand (between the *:* and *;*). Here's another example that'll get the highest value of two variables:

```
highest = (x > y) ? x : y;
```

C also has a construction similar to BASIC's ON. . .GOTO:

```
switch (exp) {
   case 1 :
      printf("exp = 1");
      break;
   case 2 :
      printf("exp = 2");
      break;
   case 3 :
      printf("exp = 3");
      break;
   default :
      printf("exp < 1 or > 3");
}
```

The switch statement works by first evaluating the expression in the parentheses, then checking the following labels to see if there's one that matches the expression's value. If there is, program execution jumps to the matching line and continues until it encounters the statement break. But what if there's no match? What if, in the above example, exp is not *1*, *2*, or *3*? That's where the label default comes in. Program execution will jump to this line if none of the other labels match. Otherwise, if there's no default, it'll jump to the next line following the end of the switch statement (after the closing brace).

What happens if we leave out the break statements? Remember I said that, once the expression following switch is evaluated, the program jumps to the matching label and continues until it encounters a break? The program doesn't care if there's no break before the next label. It'll go on, past the succeeding labels (ignoring them), and execute every statement it finds—until it either finds a break or reaches the closing brace. In the example above, if we left out all the break statements and exp evaluated to *2*, the

output would look like this:

```
exp = 2exp = 3exp < 1 or > 3
```

Under the same conditions, if exp evaluated to 3, we would see:

```
exp = 3exp < 1 or > 3
```

A new loop.

We've become very used to the while and for loop constructions. Both these are entry condition loops; that is, the loop conditional is checked *before* each iteration of the loop. There's another loop construct we've ignored so far, the do while loop.

The do while construct is an exit condition loop. The loop conditional is evaluated *after* each iteration:

```
x = 0;
do {
   ++x;
   printf("x = %d\n", x);
} while (x < 4);
```

The above would print values of x from 1 to 4. Contrast that with:

```
x = 0;
while (++x < 4) {
  printf("x = %d\n", x);
}
```

which will print values of x from 1 to 3.

And now...
break, continue and *goto.*

We talked about the break statement earlier, in conjunction with switch, but it can also be used to get out of for, while, and do while loops. When used in a nested loop construction, it only terminates the loop in which it's used. The outermost loops will continue normally.

```
while (x < 10) {
   while (y < 10) {
      if (y == 5)
         break;
      else
       printf("y is not 5\n");
       ++y;
   }
   ++x;
}
```

Another method of affecting loop execution is with continue. When continue is encountered within a loop, the loop doesn't terminate, but, instead, starts the next iteration.

```
x = 0;
while ((ch = getchar()) != '*') {
   if (ch = ' ')
      continue;
   s[x++] = ch;
}
```

Finally—though I hate to mention it, due to its inevitable abuse—C has a goto statement. The keyword goto is followed by the label identifying where program execution should continue:

```
goto print_name;

print_name: printf("Name: %s", name);
```

Quite frankly, there's little or no use for the goto statement in a structured language like C. The same goes, though not as strongly, for break and continue, except when the former is used within a switch statement. There's almost always a more structured and elegant way to get around the use of these statements. If you're a BASIC programmer, it will take you a while to get accustomed to structuring your programs in such a way as to avoid the use of a goto. But, trust me, it can be done—and the results are much more readable than BASIC's typical tangle.

The end again.

Next month, as I promised, we'll begin programming with GEM. I know you've been waiting a long time, but you'll find your patience rewarded. Now that you know most of the fundamentals of programming in C, it's time for some fun!

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CIRCLE #136 ON READER SERVICE CARD

IAN's QUEST

ST news and information

by Ian Chadwick

I think I'll write a column about games. That should be easy, right? I already know and enjoy **Time Bandit**. I'll just drop by the local Atari dealer, watch a bunch of screens, take notes, then come home. Nothing to it: add a passel of sage comments to my notes and I have a column. Okay. . .

"Got anything new in games? Like chess? Or a wargame? Something intellectual."

"Here! I have this wonderful new game. It's called **Rogue**, from Epyx," the salesman said. He leaned over to report, in a confidential voice, "It was taken from a mainframe game." And he winked, conspiratorially.

Mainframe? The last time I saw a mainframe playing games was when the awesome might of the University of Toronto's computer system massed to match me at 3-D tic-tac-toe. It lost. That was back in the days when a terminal meant a printer with a keyboard, and a video output was called a CRT. No one had CRTs then. "Show me."

Oops. He's in medium resolution, and it won't load. I see a message about "Low-rez" on the screen. It must be a translation from a mainframe that didn't speak English. They must mean "low-res"! He changes his modes, regardless. Click, click, he taps the mouse. Ah. . .color, graphics!

"It has twenty-six levels," the clerk mutters, almost adoringly. I type in my name and the first screen comes up, full of neat little walls and a little caricature of a character who looks like Bilbo, being chased by a bat.

"Nice graphics," I say, trying to dodge the bat.

"Watch. Here, go there. No. Open the door, that one. Watch out for the hobgoblin! Oh. Oh, dear."

I'm dead. Well, that was short. Twenty-six levels, eh? I choose "new game." Whirr, whirr, whirr. Back to the same initial picture. What? No reboot without having to go back to square one? Sigh. Try again. Ah, an ice monster. Hack, stab, hack, stab. I defeat it! *What* five miserable gold pieces? Grrr. . .

Okay, so I go on. I get attacked by bats and emus. Why do I feel like I'm fighting in Australia? Okay, down the stairs. There's an amulet I have to find. Use the zoom; ah, there's the stairway. What? A letter *I* attacks me. Hmm. . .killer alphabets.

"That's an ice monster," the salesman informs me. In the same climate as emus? I wonder. Trudge, trudge. Oops. I throw my bow at a centaur. Sigh; It's lost. Now I go around trying to stab monsters with arrows. Of course, I die. Again.

"Can you win at this thing?"

"I don't know, but it has twenty-six levels!"

"That doesn't answer my question."

"But twenty-six levels! Who cares if you win? Think of all the fun!"

Okay, so it's fun. It's also not very original in concept, but if a new user has never heard of or played Dungeons & Dragons™—say, if you just came from Mars—it's a nice introduction. It's not **Time Bandit**, but then again, where else can I fight emus?

Okay, so it's nicely done; I admit it. He beams at me and tells me it has twenty-six levels again. I saw only three of them. I don't know if I could last another twenty-three. At least I can save a game and return to it later (well, it also makes you quit the game if you save it. . .). My version of **Time Bandit** doesn't allow that. Maybe Gord will send me a new one.

"What else have you got?"

"You're gonna love this one: **Temple of Apshai**."

"Huh? I played that on my TRS-80 Model 1. Around the last ice age."

"The Trash 80 didn't have graphics. Or sound. Watch this." He boots it up, in low-res, just in case we get attacked by a "low-rez" warning. Hmmm.

"This has a predefined character called Brian Nailfoot. Sounds clumsy."

"You can change it," he says.

"No, leave it. I don't want to get too attached to him." Let's see, 140 pieces of silver. He's been moonlighting. Better buy a shield, some armor, a what? A Bastard-sword? Don't ask; it's only a game. Buy one anyway. Oops, I'm not strong enough. Can I take a Charles Atlas course first? No? Okay, get the broadsword. What about a bow? Twelve? Offer nine. No? Try ten. No? Eleven? Come on. . .okay, twelve. And it says *I'm* a hard bargainer—for paying what he asked! Artificial stupidity. . .so buy what you can and save the character. Now, let's try our mettle.

Ah, it's animated. I walk forward. No, not that far, stupid. Argh. Hit by a skeleton. Come back! Wait. No, hit it, bounce off, ohhh. . . I'm dead. Try again. Okay, fire a few arrows. That killed it. Grab the treasure. Hmmm. Trash. Sigh. What are my options? Ylixir? What's that, a Martian pet? Must be from the same guys who put "low rez" in the last game.

More trash. Boring. Who keeps their trash in little treasure cases in a dungeon? Carry on. . . All this trash. At least these are neat monsters. I have mushrooms, a cloak and kelp. Some treasure. I have mushrooms growing in my basement already, and who needs kelp? Maybe if I wanted to open a sushi bar. . .Ah, there's a likely looking box. And a spider. Surely I can defeat a spider, right? Wrong. I die, again.

"Okay, try this one." He pushes me aside and boots up **Swords of Kadash**, from Penguin Polarware. Penguin? I wonder if it'll be full of polar bears and ptarmigans. Nothing like killer ptarmigans. Nope. It's another D&D™ clone, I think. A slice off the old bologna, as they say. I read the opening message. Accursed villains? My favorite foes. I enter the dungeon. I choose a joystick.

It's not as well done as **Rogue**, even **Apshai**. Maybe on a par with something 8-bit, like **Crypts of Terror**. Remember that game? Ho hum. I keep hitting myself with my own arrows. I die. A lot. Luckily, this game has a benevolent deity, and I get reincarnated. A lot. It's a lot like **Lode Runner**, without quite as much fun. I pop the disk. It wasn't a lot like D&D™ after all, much to its detraction.

"Anything else?"

The clerk looks at me in exasperation. "If you don't like fantasy role-playing games, maybe you'd prefer something more action oriented." Why should I tell him I played D&D™ when he was still in diapers? These are good games, sure, but I'm not all that keen on fighting green slimes and magic centipedes. Orcs give me hives.

"**Mudpies**. Hey, this is fun. You'll love it. Trust me." I shiver when anyone says those words. A lawyer once used them to me. I'm still recovering. **Mudpies**, he tells me, is from MichTron. I wait with baited breath. Another **Time Bandit** perhaps?

"What's the point of the game?"

"You have to throw mudpies at the clowns and clear them off the screen," he says. Mudpies? Not very manly. "Make sure you keep your energy level up."

"How do I do that?"

"See those McDonald's bags? Those are fries. Eat them, the milkshakes and the burgers whenever your food indicator turns red. But not too many."

Not too many is right. I don't even eat that stuff in real life. How can I do it here? Besides, I'm a vegetarian. He shows me how to throw a pie. I bonk a clown. The others gang up on me and throw bowling pins. Sheesh!

All I have are mudpies! More come out of the holes in the walls. Bonk! Bonk! Bonk! Sigh. "I know, don't tell me. It has twenty-six levels, too."

"Look, this is good. **Red Alert**, from Antic. You've heard of them." He nudges me in the ribs. I try not to nudge him back with the disk drive. He boots up the game. "You put your cities anywhere you like, then you put your missile silos and laser bases to protect them." He spreads the items across a map of North America.

"Don't put one there." I say.

"Where, here? That's Toronto! Your hometown."

"I know. Just don't put one there. It would make me queasy if I lost it."

"All right. I'll put it here. That's Detroit." Right. Who cares if they take out someone else's hometown? "Watch." The missiles start coming in over the pole. Zap, blam. Subs pop up and shoot from the oceans. Argh! There goes San Francisco! What? What happened to Miami? The damn Cubans had missiles, and they fired at me! Sneaky weasels! I'll nuke 'em myself. Huh? I can't hit the Cubans? My mood goes black. So do my cities. More missiles approach. My silos are empty, my lasers drained. Boom, boom. Game over.

"Like that?"

"No. Too much like real life. Sort of like watching 'The Day After' over and over again. How about something less violent?"

"Do you like 007 movies? Here, try **Major Motion**."

I do. I'm driving a car with a front-aimed machine gun. Always wanted one of those things on the highway. I blast a few nasties, bump others off the road; then—squeal!—I skid into a tree. Some guy with spikes on his wheels ripped my tires! Grr. . . the truck drops me back on the road again. Wait! That guy with the spikes is still there, waiting for me to get out of the truck. Squeal! Grr. . . Next time I get a missile, I fire at him from behind. Hee, hee. . . wait! Nothing happened! Argh. Squeal. . .

Okay, this calls for serious action. I clear the road. What are tourists doing on attack alley, anyway? What! Some F15 slipped down from 12-o'clock high and nuked me. Okay. Try again. "Hey! That's a clone of this car!" I say. "How do I kill it?"

"You don't. You just have to get in the truck and hope it goes away."

"Where's the truck?"

"You'll have to wait." I can't. The clone which I can't kill is very apt at killing me. Too bad. I was just starting to like this game. I never like to play games where I don't have at least a 50-50 on an opponent.

"How about something cerebral?" I ask.

The clerk is a disappointed man. He boots up **Electro Solitaire & 21**, from Soft Logik. "Well, there's always this. . ."

"Now you're talking. Black jack? I'm a whiz. Let's see. . ." I sit down and play a hand. Hmmm. It doesn't bother to tally my score. Sloppy, I think to myself. I win! Dealer goes bust. What? The screen says "Your up $20." My up what? Could they possibly mean "you're"? Same guys who came up with "low rez," I bet. Must be a conspiracy to have all the illiterates in the world band together and write software. I try again. This time, it's a push. The dealer wins. Huh? Shouldn't it be a tie, and the money stays down? I give the clerk back the disk. "I want a game that knows the rules," I say, simply. I didn't add from someone who knows the basic rules of English.

He just shrugs and gives me **Cards** from MichTron.

"Ah, this is more like it," I say. The clerk beams. Five games in one. Blackjack, Poker Squares, Klondike, Cribbage and Solitaire. Hmmm; just called Solitaire? What's that? Ah! It's La Belle Lucie, an old and popular version of solitaire. Klondike looks familiar, except I can't select the more common three-card (rather than one) draw method. Oh well, let's try Blackjack.

Hmmm. I have 13 showing. At least it tallies my score. "How do I get another card?"

"Press 1."

"Huh? No mouse option? Why not press H for hit? You know, and S for stand? Mnemonics, you know. . ."

"Just press 1," he snarls. I do. I get an eight. Twenty-one. I win.

"What's this?"

"It's where you enter your name and bet amount."

"I just did. Last turn."

"You have to enter it every turn. It's easy; just press RETURN."

"Can't I tell it to use the figures for good?"

"Why? It's easy!"

"No mouse option?" Nope; he shakes his head. I'm a real nitpicker, he figures. I try again. It's a push situation. Ah! It lets it stand. Good work. Someone read the rules before they attempted to program. But the keyboard entry method doesn't overwhelm me. So I won't play Blackjack. The rest look good. "Wrap it. I'll take it."

The clerk falls off his chair in surprise. A sale? From me? I get up to leave. "Wait!" he shouts. "Don't you want to see **Universe II**?"

"What happened to **Universe I**?"

"It's not out for this machine."

"Call me when it is. Meanwhile, I'll practice my solitaire."

"But what about the adventures? **Sundog**? **The Pawn**? **King's Quest II**?"

"What happened to **King's Quest I**? Don't tell me—it's not out for this machine."

"**Hacker**? **Borrowed Time**? **Hitchhiker's Guide to the Galaxy**?"

"Next time!" I say and close the door behind me. I look back for a brief moment and see the clerk grabbing boxes of adventure games from the shelves, his mouth still moving. Calling out games, I guess.

Well, I got something. . . not chess, like I had really hoped, and not a wargame, but something to while away those idle moments when I don't have time for a **Time Bandit** session. Maybe I'll go back and look at the adventures next month.

I walk down the street and pass a McDonald's. I hurry past, afraid some nut with a pie in his hand will come at me.

Ian Chadwick is the author of Mapping the Atari *and other nonsense. He lives in Toronto with his wife and their small menagerie, none of whom are willing to learn any computer languages. He is currently writing mystery fiction, because he wants to publish something people can read in the john.*

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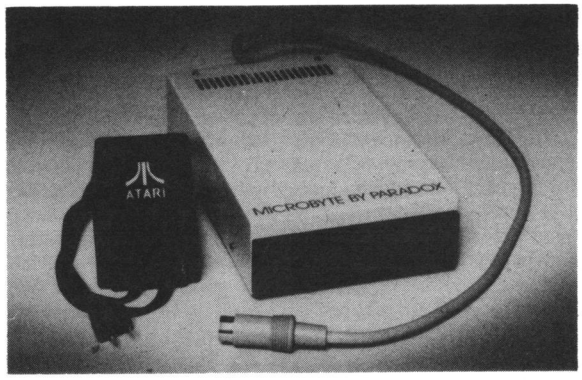

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There are four variations to **Moonmist**, the latest text adventure from Infocom, all on the same disk. Each "game" has its own puzzles, hiding place, treasure and solution. Infocom calls this an "introductory" adventure, for ages 9 and up. The company also says this one isn't just male oriented, but has a lot of appeal for women.

In traditional Infocom style, you get trinkets with the game: a visitor's guide to Tresyllian Castle, two confidential letters from your friend and an iron-on transfer.

Retail is $39.95, for both the ST and 8-bit lines, from Infocom, Inc., 125 CambridgePark Drive, Cambridge, MA 02140 — (617) 492-6000. CIRCLE #119 ON READER SERVICE CARD

UPDATED FAST/BASIC

Philon has released an upgrade of their BASIC compiler. **Version 1.35** includes full graphics interface through support of the GEM VDI graphics interface. Graphics output is produced by using PEEKs and POKEs into GEM VDI. Philon also has a BASIC interpreter out, **Henry's Fundamental BASIC**.

Philon **Fast BASIC-M, version 1.35** is $129.00, from Philon, Inc., 641 Avenue of the Americas, New York, NY 10011 — (212) 807-0303. CIRCLE #194 ON READER SERVICE CARD

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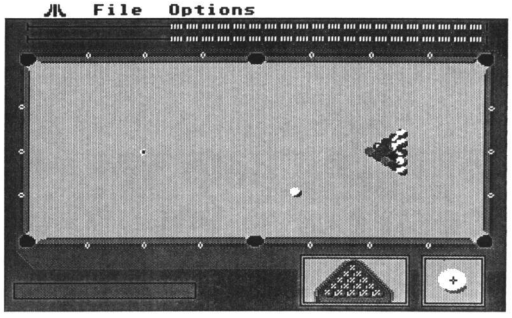

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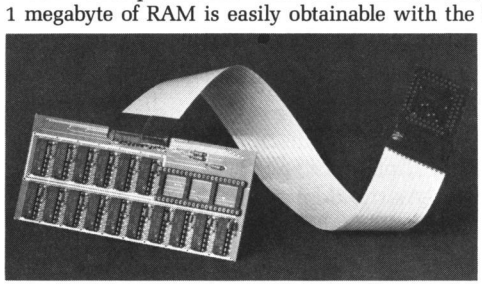

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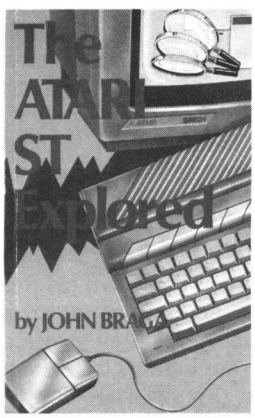
A NEW GUIDE TO GEM

The Atari ST Explored is a recently released book covering the ST's GEM operating system and ST languages. It's written for anyone considering an ST, who'd like an idea of its capabilities. Experienced users will get in-depth info on icons, windows, menus and interfaces, BASIC, Logo and assembly. By John Braga, the 250-pages are from Kuma Computers Ltd., 12 Horseshoe Park, Pangbourne, Berkshire RG8 7JW, England — 01-07357-4335. CIRCLE #194 ON READER SERVICE CARD



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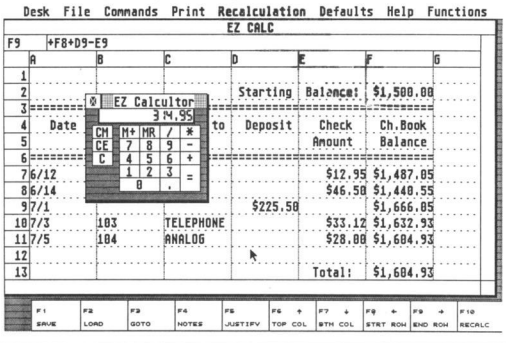

At $69.95. Royal Software, 2160 W. 11th, Eugene, OR 97402 — (503) 683-5361. CIRCLE #122 ON READER SERVICE CARD

Printer graphics tutor

Here's the help your manual doesn't give you, to do bit-image graphics on your Epson, Epson compatible, or Prowriter.

by Matthew J.W. Ratcliff

There is no such thing as a standard when it comes to printer graphics. Epson was one of the first with an expensive "Graftrax" option for their earliest MX-80 printers. Since that time, many "Epson-compatible" printers have come out, none of which is 100 percent. As the demand for inexpensive home printers with graphics capabilities has increased, several standards—of sorts—have become dominant. First and foremost is Epson; then there's the Prowriter. Earlier NEC printers used the same graphics commands as the Prowriter, but their more recent models are Epson compatible.

One of the most widely known Epson compatibles is the Star Micronics Gemini printer series. Their graphics and other features have closely followed that of the Epson, but have always been just a little behind. The SG-10 has an "IBM mode" switch which comes closer than any other previous model, but is still not totally compatible. I've been informed that their newest NX-10 indeed has a 100 percent Epson-compatible mode. Being a true Missourian, I'd have to see it to believe it.

The problem with learning how to do bit-image graphics on your own printer is the printer's manual. I have yet to see one written by a real programmer. If it were, you wouldn't see silly cartoons in it, or the useless sample program listings (which are, more often than not, incorrect). In this tutorial, I hope to show how your computer can speak graphics to your Epson or compatible, or Prowriter. Many other printers follow one of these pseudostandards to some degree, so you should still get some use from these pages.

Printer manuals make two major mistakes in teaching you bit-image graphics. First, nearly all graphics examples are symmetrical, either vertically, horizontally, or both. This is confusing to a novice trying to figure out which comes first, what's the top or bottom, and when the computer starts sending graphic bytes. Also, they always use LPRINT statements. This can cause real "mystery" problems, because the computer tries to help you out. I'll explain more on the technical problems you can run into with printer graphics, after we get the basics down.

Bit-image graphics.

The phrase *bit-image graphics* is used frequently in reference to printers and graphics. Once your printer has been put in the graphics mode with the proper "escape sequence," it accepts subsequent bytes from your computer verbatim. Each byte is made up of 8 bits. Each bit becomes a dot in your final printer graphic. If a bit is *0*, then the pin in the dot-matrix print head associated with that bit will not fire, thus leaving a white dot in your printout. If a bit is set, then the pin will fire, to create a black dot on the page. The summation of all these dots, controlled a bit at a time, is referred to as "bit-image graphics."

While learning how to do printer graphics, you'll probably define your picture on graph paper, filling in squares where you would want a dot printed. From here, it's a simple task to convert from graph paper to a binary representation. Each black dot will be a *1*, and each white dot a *0*. The binary data, grouped in chunks of 8, must be converted to decimal bytes for your data statements. A value is placed on each bit in a byte, as shown in Table 1 below. You simply add up the values for each bit that's set *(1)* and you have the decimal representation. A programmer's cal-

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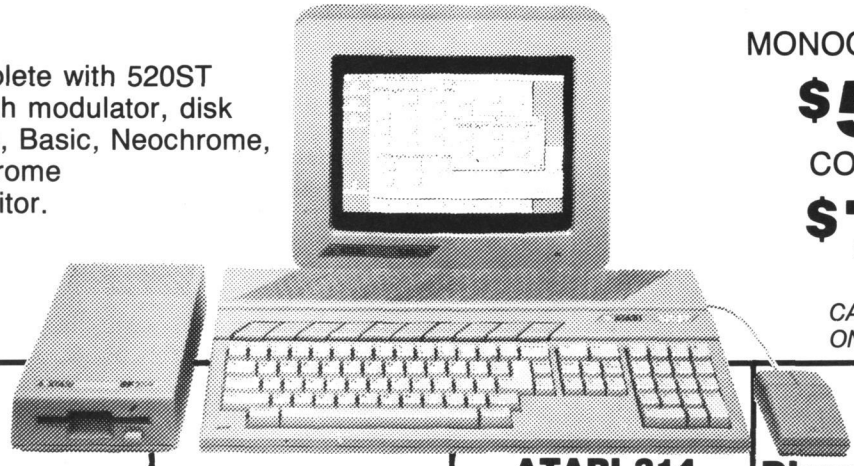

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CIRCLE #142 ON READER SERVICE CARD

culator with binary capabilities is very helpful in this process. (The Casio FX450, which has extensive hexedecimal and binary calculation features and sells for under $30.00 is also a full-function scientific calculator and never needs batteries; it's solar.)

Table 1.

```
7 6 5 4 3 2 1 0 ← Bit Positions
| | | | | | | |
1 | | | | | | |
2 6 3 1 | | | | ← Bit Values
8 4 2 6 8 4 2 1
| | | | | | | |
1 0 1 0 0 1 1 0   Sample Binary Representation
                  of Decimal 166
                  =128*1+64*0+32*1+16*0
                  +8*0+4*1+ *1+1*0
                  =128+32+4+2=166
```

Bytes to graphics.

The print head in a dot-matrix printer is made up of a vertical column of small pins. When your printer outputs text, it fires these pins in a predefined sequence from a character set "bit map" it stores in its own ROM. When we want to send it bit-image graphics, we must first tell the printer, "accept the following 43 bytes of data as graphics," for example. The printer expects what we commonly refer to as an "escape sequence." When most printers see a *CHR$(27)* (escape code), it knows that a command follows.

After sending the proper escape code, the bit-image graphics bytes follow. Part of the escape code tells the printer how many bytes to interpret as graphic data. That way, escape characters within the graphics data won't inadvertently be interpreted as more commands.

When printing simple text, the top seven of nine pins are used for uppercase, and lowercase which doesn't require descenders. The lower seven of nine are used for lowercase characters with descenders (such as *p, y, q,* etc.). The bottom pin is turned on whenever continuous underline is enabled, also. When we're sending graphics data bytes to the printer, we take control of the top eight pins. Here, it's best to think in binary. When you send a graphic byte to the printer, each bit controls an individual pin in the print head. For the Epson and compatibles, you can see in Figure 1 that the least significant bit controls pin 8 and the most significant bit controls the top pin, pin 1. In the case of the Prowriter and its compatibles, the reverse is true, as shown in Figure 2. The least significant bit controls the firing of the top pin of the print head, and the most significant bit controls pin 8.

Take a look at Figure 3. Here, a simple graphic of a space shuttle is defined. It's eight dots high and thirteen dots wide. Each dot column is defined by a single graphic byte from your computer. To make it easier to visualize, think of rotating the print head, pivoting at the bottom, to the left for Epson and to the right for Prowriter. In the figure, I've taken care of all the arithmetic for you. If your graphic must be taller, you can create it on a larger grid. You simply break it up vertically in groups of eight rows. You would send the graphics data for the first row (after the appropriate escape codes), print a carriage return (and line feed for the ST), then the next row—and so on. More details later.

The computer and printer.

At this point, you should type and run the appropriate program. If you have an ST and an Epson or compatible, type and run the first program example. It will print our

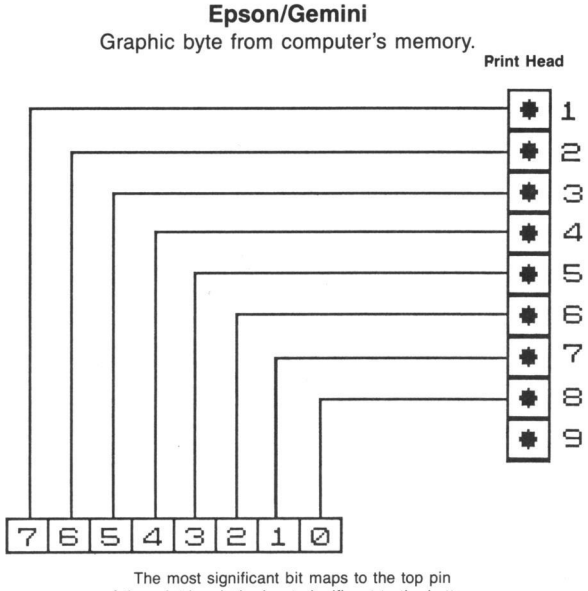

Figure 1.
Epson/Gemini graphics byte to print head control example.
ST DISK FILE: EPSGEM.PI3
A DEGAS high-resolution graphics file.

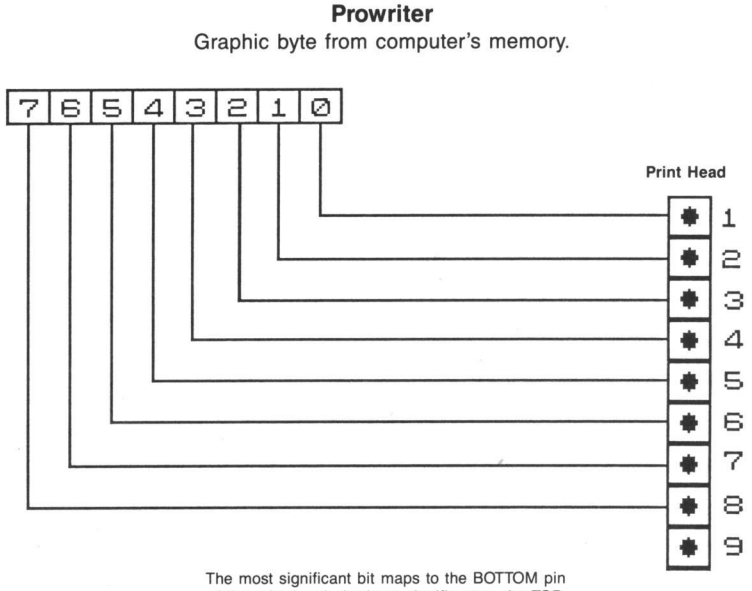

Figure 2.
Prowriter graphics byte to print head control example.
ST DISK FILE: NECPRO.PI3
A DEGAS high-resolution graphics file.

shuttle in single-, dual- and quad-density graphics, respectively, ten shuttles per line. Note that Line 120 has a lowercase z as part of its escape code sequence. That's the code used to set the Gemini 10X (or SG10 in the Star Mode) in quad density. This should be changed to an uppercase *Z* for Epson and other, *more compatible* printers. The same change should be made for the second program listing, but at Line 130. This is for 8-bit Atari computers equipped with Epson or compatible printers.

Listing 3 is for Prowriter or compatible owners, and ST BASIC. Finally, Listing 4 is for 8-bit Ataris and the Prowriter. If you're using a Prowriter compatible (like an older NEC printer), you may find that all shuttles look the same size. Some are graphics command compatible with the Prowriter, but do not have variable dot densities.

The escape codes.

Each printer has a certain character sequence, usually preceded by the escape character, *CHR$(27)*, that tells it what special function to perform. For the Prowriter, you must send the escape code, followed by the ASCII equivalent of the letter *S*, which is *83*. Immediately following that, the Prowriter expects four characters telling it how many graphic bytes follow. This must be an ASCII string, padded with 0s, if necessary. Graphics density on the Prowriter is set by selecting print pitch, as shown in the sample programs. On the ST, for example, we could use the following to tell the Prowriter that 265 bytes of bit-image graphics data is on its way:

```
LPRINT CHR$(27);"S0265";
```

Then 265 bytes of bit-image graphics data must follow.

For the Epson and compatibles, the printer expects the escape character, followed by a lead-in code. This code tells the printer that bit-image graphics bytes are on their way and selects density, as well. Changing print pitch has no effect on the density of graphics, as it does with the Prowriter.

After the lead-in code, the Epson or compatible expects 2 bytes telling it the total number of bit-image graphics characters to follow. The first byte sent will be the low byte, followed by the high byte. So, if we were sending 265 bytes of graphic data to an Epson, it might appear as follows on the ST:

```
LPRINT CHR$(27);"K";CHR$(9);CHR$(1);
```

Why 9 and then 1? What is 9+256*1? That comes out to *265*. Old 8-bit Atarians should be familiar with the high-byte, low-byte format of addressing in the machine. The Epson thinks similarly.

Bit-image graphics density determines the total number of dots per print line, and how close together the dot spacing will be—as you can see from the samples. Single-density graphics on the Epson come out to 480 dots per line; dual is 960, and quad density gives you 1920. On the Prowriter, setting 10 characters per inch (CPI) print pitch will give you 640 dots per line in subsequent bit-image graphic functions. Setting 12 CPI gives 786 dots per line, 17 CPI results in 1088, and proportional spacing will select 1280 dots per line. Look at the listings to see how these are selected with different escape code sequences.

Why not LPRINTs?

Notice that none of the programs use the LPRINT statement any more than is absolutely necessary. The LPRINT poses particular problems on most computers when it comes to bit-image graphics. On the 8-bit Atari, the LPRINT is sent from a 40-character print buffer in the computer. If your LPRINT line is less than 40 characters, then the rest of the line is padded with NULLs, *CHR$(0)*. This really goofs up the bit-image graphics count, set up with the escape code.

On the ST, I found no problems with LPRINT, but avoided it anyway. Note that our space shuttle is thirteen dot columns wide. In the escape code sequence for the Epson, telling the printer how many graphics dots are to follow, there will be a *CHR$(13)* sent. On the ST, the operating system is smart enough to know if an ASCII *13* is being sent at the end of a line, and, thus, should be followed with a LINE FEED, *CHR$(10)*. If not at the end of a line, then only the *CHR$(13)* is sent, unmolested. While testing some of my routines on the IBM PC, however, I found that their BASICA *always* sends a line feed after a *CHR$(13)*, whether it's at the end of a line or not. I used the "out 0" command with the ST BASIC, because I knew this couldn't possibly be misinterpreted by the computer. This simply tells the ST to send a single byte out port 0, the printer, no questions asked. The LPRINT may have some other hidden "features," where it might misinterpret graphic data going to your printer. On the 8-bit Atari, *PUT #1* (where you had previously done an *OPEN #1,8,0,"P:"*), is equivalent to the "out 0" command of the ST.

In the Epson example above, we were sending 265 graphics bytes to the printer. That poses a problem on some computers. Sending the *CHR$(9)* to the printer from the LPRINT works fine on the ST, but another computer I use interprets a *CHR$(9)* as a TAB character. The computer thinks, "a tab character. . . let's help out by converting that to eight space characters." Of course, that will clobber your bit-image graphics, too. The *CHR$(9)* doesn't pose a problem on the 8-bit Atari or ST computers, but it's something to keep in mind if you work on other (heaven forbid), non-Atari computers.

In the ST BASIC sample listings, note the "width lprint 255" command. Similar to IBM BASICA, ST BASIC assumes that your printer is only 80 columns wide. Normally, ST BASIC will automatically send a carriage return and line feed to your printer once every 80 characters you send to it, if you don't. If you're running a 15-inch carriage printer (such as the Gemini 15X or the Epson FX185), then your printer can handle 132 characters per line. This can be set from ST BASIC with a "width lprint 132" command. However, when it comes to bit-image graphics, we may send as many as 1920 graphics bytes in quad density without a return. When ST BASIC sees that you have set the width of the printer to 255 columns, it shuts off all checking and will not send a carriage return/line feed combination, unless told to under your software control.

Additional 8-bit limitations.

One thing many 8-bit owners don't realize is that you absolutely cannot send a *CHR$(155)* to your printer. Why?

The 8-bit Atari uses a *155* as a carriage return representation. The printer driver in the 850, **P:R: Connection** or similar printer interface, always converts the *155* to a standard return value of *13*. What if you wanted to send 155 graphic bytes to your Epson on an 8-bit Atari? You can't, because the printer interface helps you out:

```
10 OPEN #1,8,0,"P:"
20 PRINT #1;CHR$(27);"K";CHR$(155);CHR
$(0);
```

In the above segment of code, the printer interface would see the *155* coming out and convert it to a *13* before it got to your printer. (The same holds true if you use *PUT #1,155*.) Then your Epson would expect only 13 graphic bytes, while you want to send 155 of them. Of course, the simplest solution is to change your setup to send 156 graphic bytes, instead. You could then send a dummy graphic byte at the end, without messing up the picture.

Usually, with screen dumps and other graphic utilities, you're sending an entire line of bit-image graphics. You know ahead of time how many bytes need to be sent, and can avoid that particular problem. But what if your bit-image graphics line going to the printer happens to have *155*s in it? They'll be converted to *13*s by the printer interface and goof up the graphic. Many graphic dump utilities for 8-bit Ataris have this little-known bug. A smart graphics utility would look for *155*s and convert them "on the fly" to *153*s, possibly (which are similar enough in bit-image graphics to go unnoticed).

P:R: Connection owners should also take note of another special feature where they get unwanted help. If you're sharing the printer between the ST and 8-bit Atari, as I do, then you probably have the line feed switch set in the **P:R:** box. That way, you don't have to change the auto-line-feed dip switch in the printer when you swap it between the two computers. Whenever the **P:R:** sees a *155* going to the printer with this switch set, not only does it convert the number to a *13*, it also sends a line feed, *10*, to follow up (similar to the problem noted above with the IBM).

This problem never appears in **The Print Shop**. The program avoids the potential 155 problem in a completely different way. **The Print Shop** always drives the bottom seven of eight pins on the Epson, or the top seven of eight on the Prowriter, used for bit- image graphics. This results in the lower seven bits of each graphic byte being used to define the image, with the most significant bit always *0*. In other words, the maximum value of any graphic byte going to the printer is *127*, so the 155 glitch will never appear. The programmable line feed of the printer is adjusted under software control for proper vertical alignment of your graphic rows.

Vertical spacing on Epson.

It's not likely that all your graphics will be only eight dots high, as are the sample programs. Line spacing for your printer is normally set for text at about ⅙ of an inch, or sixty-six lines per page maximum. For bit-image graphics, we want each graphic line to stack one exactly above the next, with no extra white space between. On the Epson and Gemini printers, assuming eight bit-image graph-

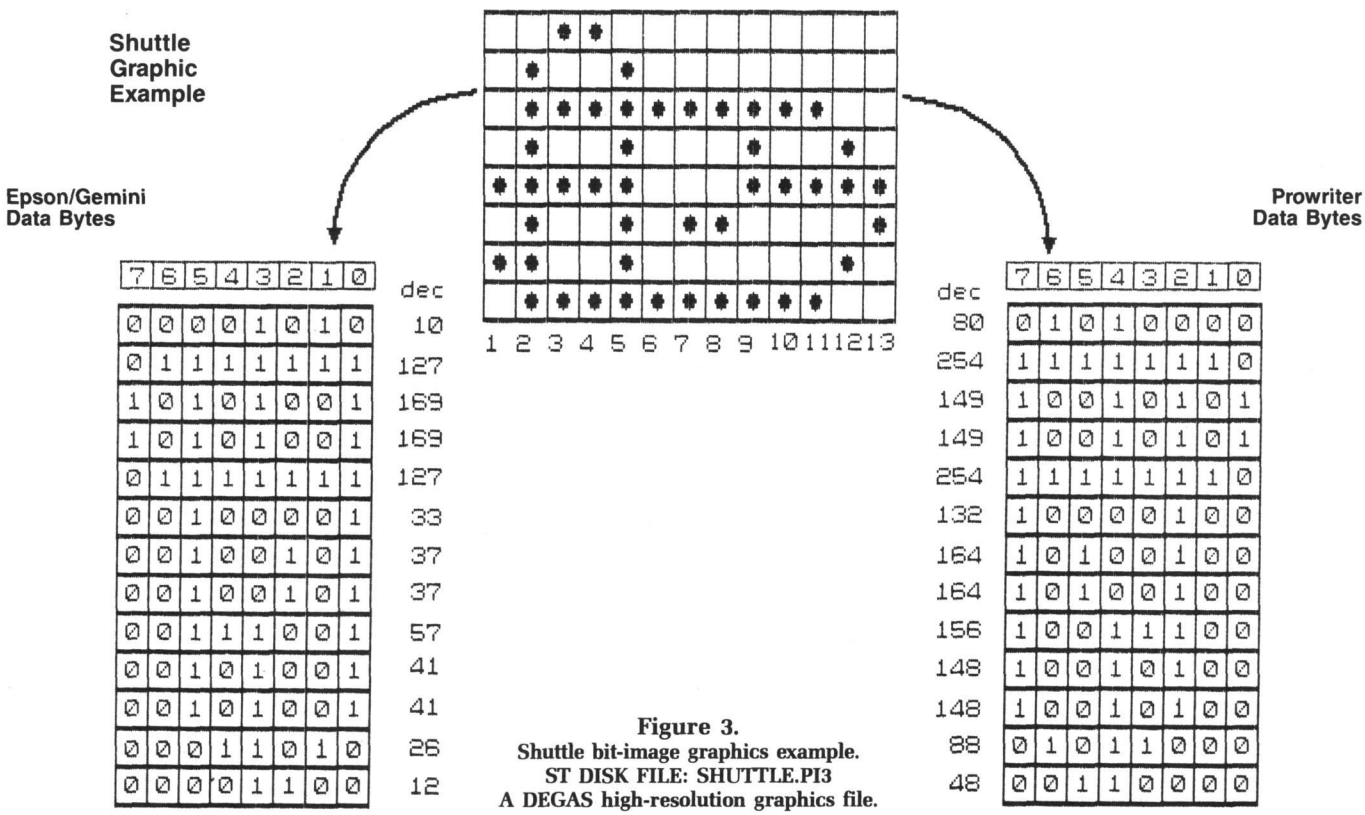

Figure 3.
Shuttle bit-image graphics example.
ST DISK FILE: SHUTTLE.PI3
A DEGAS high-resolution graphics file.

ics, you'll want $^{8}/_{72}$ line spacing. If only using seven pins, as in the **The Print Shop**, then set $^{7}/_{72}$. The vertical spacing is set on the Epson and compatibles with the ESCAPE-A command, followed by a byte (between *0* and *127*), specifying the new setting in 72nds of an inch for each line feed the printer does. In ST BASIC, it could be set with the following:

```
LPRINT CHR$(27);"A";CHR$(8);
```

Or, avoiding LPRINT as suggested, the following would work just as well:

```
OUT 0,27:OUT 0,ASC("A"):OUT 0,8
```

Both the Epson and Gemini printers have another programmable line feed control, the ESCAPE-J command. On all Gemini printers through the SG-10 (whether in the Star or IBM mode), this programs the line feeds in increments of 144ths of an inch.

On the Epson, however, it programs in increments of 216ths of an inch. This "minor incompatibility" has been a *major* source of headaches for Gemini owners over the past few years. Any time you get Epson-compatible graphic software that gives you extra white space between every graphic line on your Gemini, you can bet they're using the ESCAPE-J command, instead of the more universal ESCAPE-A.

Why would anyone want to use ESCAPE-J? Well, the dots line up properly using the $^{8}/_{72}$-inch increment, but sometimes graphics dump routines need even finer control over the line feed, to adjust for aspect ratio (proportionality) in your output.

If the newest Gemini, the NX10, programs in increments of 216ths of an inch with the ESCAPE-J command, then maybe —just maybe—it's finally 100 percent Epson compatible.

Vertical spacing on Prowriter.

The Prowriter's line feed is programmed in increments of 144ths of an inch, with the ESCAPE-T command. To set $^{8}/_{72}$- or $^{16}/_{144}$-inch line spacing, you can use one of the following from ST BASIC:

```
LPRINT CHR$(27);"T16";
```

or:

```
OUT 0,27:OUT 0,ASC("T"):OUT 0,ASC("1")
:OUT 0,ASC("6")
```

A final Epson note.

As more escape commands have been added to newer Epson and Gemini printers, some are followed by a *0* to disable, or *1* to enable a particular feature. For example, the following turn on continuous double-width printing on the Epson and Gemini printers:

```
LPRINT CHR$(27);"W";CHR$(1)
```

or:

```
OUT 0,27:OUT 0,ASC("W"):OUT 0,1
```

(continued on next page)

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  - Interrupt structure
- Dynamic strings that may be any size
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- Procedure variables
- Module version control
- Programmer definable scope of objects
- Open array parameters (VAR r: ARRAY OF REALS;)
- Elegant type transfer functions

Ramdisk Benchmarks (secs)	Compile	Link	Execute	Optomized Size
Sieve of Eratosthenes:	6.2	4.3	3.5	2600 bytes
Float	6.4	4.8	8.3	4844 bytes
Calc	5.5	4.2	3.3	2878 bytes
Null program	5.1	3.2	—	2370 bytes

```
MODULE  Sieve;
CONST   Size = 8190;
TYPE    FlagRange = [0..Size];
        FlagSet = SET OF FlagRange;
VAR     Flags: FlagSet;
        i:     FlagRange;
        Prime, k, Count, Iter: CARDINAL;
BEGIN   (*$S-,$R-,$A+ *)
  FOR Iter:= 1 TO 10 DO
    Count:= 0;
    Flags:= FlagSet(); (* empty set *)
    FOR i:= 0 TO Size DO
      IF (i IN Flags) THEN
        Prime:= (i * 2) + 3; k:= i + Prime:
        WHILE k <= Size DO
          INCL (Flags, k);
          k:= k + Prime;
        END;
        Count:= Count + 1:
      END;
    END;
  END;
END Sieve.
```

```
MODULE Float;
FROM MathLib0 IMPORT sin, ln, exp,
                     sqrt, arctan;
VAR x,y: REAL; i: CARDINAL;
BEGIN (*$T-,$A-,$S-*)
  x:= 1.0;
  FOR i:= 1 TO 1000 DO
    y:= sin (x); y:= ln (x); y:= exp (x);
    y:= sqrt (x); y:= arctan (x);
    x:= x + 0.01;
  END;
END float.
```

```
MODULE calc;
VAR a,b,c; REAL; n, i: CARDINAL;
BEGIN (*$T-,$A-,$S-*)
  n:= 5000;
  a:= 2.71828; b:= 3.14159; c:= 1.0;
  FOR i:= I TO n DO
    c:= c*a; c:= c*b; c:= c/a; c:= c/b;
  END;
END calc.
```

Product History

The TDI Modula-2 compiler has been running on the Pinnacle supermicro (Aug. '84), Amiga (Jan. '86) and will soon appear on the Macintosh and UNIX in the 4th Qtr. '86.

Regular Version $79.95 Developer's Version $149.95 Commercial Version $299.95

The regular version contains all the features listed above. The developer's version supplies an extra diskette containing a symbol file decoder – link and load file disassemblers – a source file cross referencer – symbolic debugger – high level Windows library Module – Ramdisk and Print Spooler source files – Resource Compiler. The commercial version contains all of the Atari module source files.

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I've frequently seen this shown (translated to ST BASIC) in printer manuals, as follows:

```
LPRINT CHR$(27);"W1"
```

This is wrong, however, and will not work. Many printer manuals show it incorrectly. The Epson and Gemini printers expect a *CHR$(1)* not *1*, or *CHR$(49)*. This does get confusing.

Now, the newer Epson FX printers don't care. They'll accept *either* of the above as a valid command sequence, but only the former will work properly on the Gemini and many other Epson compatibles. In other words, Epson is making up for deficiencies in their past documentation with updates in the printer's ROM control software. It will, of course, create more confusion among other Epson compatible users.

Normally, if the third byte of an escape code is shown as a *0* or *1* only, then send *CHR$(0)* or *CHR$(1)* not *0*, which is *CHR$(48)*, or *1*, which is *CHR$(49)*. If you use the former, you'll be guaranteed compatibility with virtually all Epson-compatible printers (and older Epson models), not just the newest Epson FX series. (I wonder if Star Micronics caught this little trick before releasing their new NX/NL printer series? If not, then it *still* isn't 100 percent Epson compatible, is it?)

Wrap up.

I hope this tutorial has helped you understand how to speak graphics to your printer. The sample programs were kept brief and simple, so you can see the essence of computer-controlled printer graphics. Armed with this more accurate information and specific program examples for your computer, you should be able to make more sense out of your printer manual—and tackle that printer graphics utility you've been wanting to write.

I would like to thank Phil Bunch of Comm Tech computer services in St. Louis, Missouri for his valuable Prowriter assistance in developing this tutorial.

The two-letter checksum code preceding the line numbers in the 8-bit BASIC listings here is *not* a part of the BASIC program. For further information, see the *BASIC Editor II* in issue 47.

Listing 1.
ST BASIC listing.

```
10 fullw 2:clearw 2:width lprint 255
20 gotoxy 1,1:? "SHUTTLE Graphics:"
30 for j%=1 to 3
40 on j% goto 50,60,70
50 ? "Single";:lprint "Single Density
Graphics:":goto 80
60 ? "Dual";:lprint "Dual Density Grap
hics:":goto 80
70 ? "Quad";:lprint "Quad Density Grap
hics:"
80 for i%=1 to 10
90 out 0,27:on j% goto 100,110,120
100 out 0,asc("K"):goto 130:rem sgl de
ns Graphics Select
110 out 0,asc("L"):goto 130:rem dbl de
ns Graphics Select
120 out 0,asc("z"):rem Gemini, use "Z"
 for Epson printers
130 out 0,13:out 0,0:rem Lo,Hi bytes o
f total Graphics chrs
140 restore
150 for k%=1 to 13
160 read a%:out 0,a%
170 next k%
180 lprint "  ";
190 next i%
200 lprint:lprint:? " done.";chr$(7)
210 next j%
220 closew 2
230 end
240 data 10,127,169,169,127,33,37,37,5
7,41,41,26,12
```

ST CHECKSUM DATA.

(see page 56ST)

```
 10 data  754, 902, 900, 426, 855, 766
, 861, 47, 801, 34, 6346
 110 data  14, 240, 514, 549, 956, 342
, 399, 757, 401, 812, 4984
 210 data  381, 435, 786, 180, 1782
```


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Listing 2.
BASIC listing.

```
BJ 10 GRAPHICS 0:POKE 752,1
TY 20 ? "Shuttle Graphics:"
GO 30 OPEN #1,8,0,"P:"
EC 40 FOR J=1 TO 3
PT 50 ON J GOTO 60,70,80
WB 60 ? "Single";:? #1;"Single Density Gr
   aphics:":GOTO 90
R5 70 ? "Double";:? #1;"Dual Density Grap
   hics:":GOTO 90
NL 80 ? "Quad";:? #1;"Quad Density Graphi
   cs:"
GJ 90 FOR I=1 TO 10
DN 100 PUT #1,27:ON J GOTO 110,120,130
QV 110 PUT #1,ASC("K"):GOTO 140:REM sgl d
   ens graphics select
RF 120 PUT #1,ASC("L"):GOTO 140:REM dbl d
   ens graphics select
VU 130 PUT #1,ASC("z"):REM Gemini quad se
   l, use "Z" for Epson printers
VB 140 PUT #1,13:PUT #1,0:REM Lo,Hi bytes
    of total graphics bytes to send
CK 150 RESTORE
TO 160 FOR K=1 TO 13
FZ 170 READ A:PUT #1,A
HB 180 NEXT K
PI 190 ? #1;"  ";
FS 200 NEXT I
TE 210 ? #1:? #1:? " done."
II 220 FOR W=15 TO 0 STEP -0.15:SOUND 0,6
   0,10,W:NEXT W:SOUND 0,0,0,0
GI 230 NEXT J
VD 240 POKE 752,0:CLOSE #1:? "** Finished
    **"
OB 250 END
MD 260 DATA 10,127,169,169,127,33,37,37,5
   7,41,41,26,12
```

●

Listing 3.
ST BASIC listing.

```
10 fullw 2:clearw 2:width lprint 255
20 gotoxy 1,1:? "SHUTTLE Graphics:"
30 for j%=1 to 4
40 on j% goto 50,60,70,80
50 ? "640 Dots";:lprint "640 Dots/Line
 Density:":goto 90
60 ? "786 Dots";:lprint "786 Dots/Line
 Density:":goto 90
70 ? "1088 Dots";:lprint "1088 Dots/Li
ne Density:":goto 90
80 ? "1280 Dots";:lprint "1280 Dots/Li
ne Density:"
90 out 0,27:on j% goto 100,110,120,130
100 out 0,asc("N"):goto 140:rem 640 Do
ts, 10 CPI select
110 out 0,asc("E"):goto 140:rem 786 Do
ts, 12 CPI select
120 out 0,asc("Q"):goto 140:rem 1088 D
ots, 17 CPI select
130 out 0,asc("P"):rem 1280 Dots, Prop
ortional Print Select
140 for i%=1 to 10
150 out 0,27:out 0,asc("S"):rem select
 bit image graphics
160 lprint "0013";:rem 13 Graphics byt
es to send
170 restore
180 for k%=1 to 13
190 read a%:out 0,a%
200 next k%
210 lprint "  ";
220 next i%
230 lprint:lprint:? " done.";chr$(7)
240 next j%
250 closew 2
260 end
270 data 80,254,149,149,254,132,164,16
4,156,148,148,88,48
```

●

ST CHECKSUM DATA.
(see page 56ST)

```
 10 data  754, 902, 902, 710, 99, 140,
 995, 55, 228, 587, 5372
 110 data  605, 715, 574, 948, 64, 809
, 558, 965, 351, 380, 5969
 210 data  738, 382, 821, 390, 444, 79
5, 866, 4436
```

●

Listing 4.
BASIC listing.

```
BJ 10 GRAPHICS 0:POKE 752,1
TY 20 ? "Shuttle Graphics:"
GO 30 OPEN #1,8,0,"P:"
ER 40 FOR J=1 TO 4
RS 50 ON J GOTO 60,70,80,90
ES 60 ? "640 Dots";:? #1;"640 Dots/Line D
   ensity:":GOTO 100
TC 70 ? "786 Dots";:? #1;"786 Dots/Line D
   ensity:":GOTO 100
PP 80 ? "1088 Dots";:? #1;"1088 Dots/Line
    Density:":GOTO 100
PZ 90 ? "1280 Dots";:? #1;"1280 Dots/Line
    Density:"
WE 100 PUT #1,27:ON J GOTO 110,120,130,14
   0
OJ 110 PUT #1,ASC("N"):GOTO 150:REM 640 D
   ots, 10 CPI select
BA 120 PUT #1,ASC("E"):GOTO 150:REM 786 D
   ots, 12 CPI select
KX 130 PUT #1,ASC("Q"):GOTO 150:REM 1088
   Dots, 17 CPI select
XO 140 PUT #1,ASC("P"):REM 1280 Dots, Pro
   portional Print select
QV 150 FOR I=1 TO 10
RP 160 PUT #1,27:PUT #1,ASC("S"):REM Sele
   ct Bit Image Graphics
WO 170 PRINT #1;"0013";:REM 13 Bytes of g
   raphic data
CQ 180 RESTORE
TU 190 FOR K=1 TO 13
FM 200 READ A:PUT #1,A
GO 210 NEXT K
OV 220 ? #1;"  ";
FY 230 NEXT I
TK 240 ? #1:? #1:? " done."
IO 250 FOR W=15 TO 0 STEP -0.15:SOUND 0,6
   0,10,W:NEXT W:SOUND 0,0,0,0
GO 260 NEXT J
VJ 270 POKE 752,0:CLOSE #1:? "** Finished
    **"
OH 280 END
NS 290 DATA 80,254,149,149,254,132,164,16
   4,156,148,148,88,48
```

●

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by Douglas Weir

Time flies, doesn't it? Only twelve months ago the ST was beginning to appear in stores. Soon after that I was compiling my first program with Alcyon C. It finished linking sometime in early February of this year. My second one is a special Christmas project (Christmas 1988). I hope it finishes soon—I'm already behind schedule.

But seriously, folks. . . When the **Megamax C** compiler arrived, I had been trying for several hours to link a desk accessory version of a GEM demonstration program with DRI's Link68. In desperation I turned to **Megamax**. In less than 15 minutes I had the program compiled and linked. It ran beautifully. I've never used Alcyon since.

Megamax C (**MMC**) is distributed on two single-sided disks. Included is the compiler and linker, plus a disassembler, code improver, librarian and resource construction program (similar to the Resource Construction Set supplied with the Atari Developer's Kit). These programs can be run from a GEM-driven shell program also included, or directly from the desktop (as .TTP applications), or with any command shell processor (the manual mentions Beckemeyer C-Shell as an example; I used the command.tos from Atari).

The **MMC** shell includes a "make" feature for compiling and linking multiple source files. A GEM-driven editor is also supplied. It operates more or less on the **1st Word** model, but I found it rather clumsy and used **1st Word** instead, with no problem.

Compiling and linking a program is very easy, partly because there are essentially no compiler or linker options. Only one source file can be compiled at a time. The output object file will be written to the same disk (and directory) as the source file. Error messages are written to the screen and also to a file named errors.out, on the same disk as the source file.

A "Megamax" folder is required to be in the root directory of the disk the compiler or linker is on. This folder contains the libraries and header files.

The compiler is one-pass, and as a result it is fast—almost unbelievably so at first (some timings are given in Table 1, at the end of this review). Also as a result, and in the true C spirit, error checking is limited. I never realized I had a redefined macro in a fairly large GEM program I had written, until I put it through the **Mark Williams** compiler. But that's part of the language. As the famous French programmer, Gaston de Gautou, said, "The C, she is a harsh mistress, no?"

The linker's lone option allows you to override the default name (a.out) and destination of the output file. Of course, you can also specify extra libraries to be searched.

The **MMC** library system is very simple. Virtually everything (including AES and VDI calls) comes out of syslib, which is searched automatically. There are two other libraries. Double.l is used for double-precision arithmetic, and acc.l is used when linking desk accessories (the only extra step in creating an accessory). Otherwise, you specify libraries only when you want to use ones created with the **MMC** librarian.

Some peculiarities should be noted. First, the linker builds on its disk a temporary file from which the run file is finally written, and it must have enough space to do so. For those using only floppy disk drives, this means the linker has to have a disk pretty much to itself (except for the Megamax folder and libraries). The location of this temporary file (in contrast to that of the destination file) cannot be overridden.

Second, there is no list of linker error messages in the manual. Some of these can be a bit mystifying. **MMC** does not allow the size of separate data structures (such as arrays or structures), or the data segment as a whole, to exceed 32K bytes. You can easily get around this by declaring pointers instead, then allocating whatever memory you need at runtime with calloc() or malloc(). If you forget about this and, say, declare a 32000-element array of int, you may get a reasonable error message from the linker, saying you've exceeded the allowable data space, but you could instead get the message *couldn't find some local labels*. This is the linker's way of telling you the data segment is exhausted. You can also get the *couldn't find* message by using a label (for example, *goto jail*) without declaring it.

Object modules produced by the **MMC** compiler are, as you might expect, incompatible with anyone else's. Syslib includes bindings for all GEM calls listed in the VDI and AES manuals, but not all of them are documented in the **MMC** manual.

As Clayton Walnum pointed out in an earlier installment of **C-manship**, the behavior of **MMC**'s implementation of getchar() is rather odd. The function doesn't

return from a call until it encounters a carriage return, so you have to use something like Cconin() to get a character immediately.

You can get the source code for the entire **MMC** library, including the GEM bindings, by sending $50.00 to Megamax. Much of the code is written for the compiler's in-line assembler, which is a delight to use. In-line assembly code begins with the keyword asm and a left-hand curly bracket, and is terminated with a right-hand curly bracket. Macros can be implemented with the #define directive.

The assembler adheres to standard Motorola syntax—the only real exception is that register names must be in upper case. Both local and global variables in your program are accessible to the assembly code; the variables are addressed by using register A4 (external and static) or A6 (local) as a base register. Since in-line code is located entirely in the code segment of a C program, you can't explicitly write to variable space allocated within the code. However, if you need to use either of these registers for something else, you can save it with the trick in Figure 1.

The assembler has only one bug that I could find. The last line of assembly code must be commented (e.g., see the ;and return in Figure 1), otherwise you will get an *instruction syntax error* from the compiler. The #include directive can be used in the middle of asm blocks to include other assembly code files. Both C-style and Motorola-style comments are accepted; you can use the former to comment out blocks of code containing the latter.

Using **Megamax** to "compile" a large file of in-line assembly code will be much faster than simply assembling with many of the stand-alone assemblers currently available. You can use the **MMC** disassembler as an aid to writing optimized in-line code, but you can't directly "tweak" the compiler's output, since there is no separate assembly pass. The disassembler is as easy to use as the other parts of the package.

A "code improver" program performs branch optimizations on an object file. The manual says that output code is "about 3% faster and 10% smaller" than the original. The improver affects only the nonlibrary portion of your code.

MMC contains the following important extensions: structure and union assignment, and passing to and from functions; character constants can consist of one, two or four characters between single quotes; significant length of identifiers (variable names, etc.) is ten characters; four data and two address registers are available for register variables.

MMC does not allow a program's size to exceed 32K bytes. To get around this, the compiler implements an "overlay" directive that allows you to break up a program into smaller parts. Note that these are not dynamic overlays; the effect of using this directive is simply to generate a multisegment program, all of which is loaded into memory at runtime. In other words, overlays are transparent to the programmer.

The **MMC** manual comes in a full-size, loose-leaf ring binder. The documentation is mostly well written, and there is a lot of it—over 370 pages. The GEM calls (with the exceptions noted above) are covered.

Megamax requires no royalties for commercial programs developed with its C package. It is my favorite C compiler of all those now available for the ST. For users without a hard disk, it's the only sane choice. I love this compiler.

Mark Williams C (**MWC**) is not just a C compiler—it's more like a way of life. **MWC** came (in my review copy) on two double-sided disks (a single-sided version is available, according to an enclosed note). Installation takes the better part of an hour on a floppy-disk-based ST, just to build the system's directory structure and copy the necessary files. The paperback manual contains over 600 pages, every one of which comes in handy. The result is a system that has a lot of the feel of a mainframe UNIX, but which requires a hard disk for optimum performance.

The compiler is larger than Megamax's; the programs that make up its multiple passes total over 200K bytes, as opposed to 73K for the one-pass **Megamax C**. This means that **MWC** is slower than **Megamax C**. But you get a lot in return: a rich set of compiler and linker options, extended error checking (if desired) and the ability to link to object modules in standard DRI format.

The compiler is only one of many commands and utilities available to the UNIX-like command processor. Others include egrep, sort, diff, history, wc and make. I/O redirection, pipes and scripts (batch files) are supported. This system (called msh for micro-shell) is nicer than any of the other ST command shells I've seen.

You must have about 128K bytes of free memory to use make. In the command shell, you can type mf to find out how much memory is available.

On a floppy system, you obviously can't have access to all of **MWC**'s features at the same time. Instead, you put msh and the utilities on one disk and the compiler on the other. There's a full-screen (non-GEM) editor, MicroEMACS, with source code (which is definitely not "micro"). It's similar to Mince and the other EMACS-like editors. I used **1st Word** instead, and had no trouble doing so.

Also included is a symbolic debugger that allows you to monitor the execution of a compiled program. The debugger does not require a special compilation of the file to be debugged, but the file must be compiled under **MWC**. You can set breakpoints, patch values into memory and disassemble code. You can display the current contents of machine registers, but I couldn't find a way to change register values (none is mentioned in the manual). The debugger works only with TOS-type applications, not with GEM programs.

I found it very easy to port my Alcyon and Megamax source code over to **MWC**. The modifications involved header files only.

The advertising for **MWC** mentions "Lint-like error checking." Lint is a program included with some C packages to check for a lot of the little things that normal C compilers don't: variables that aren't used, data type mixups, etc. **MWC** certainly does much more than the usual checking. For example, it caught a redefined macro that slipped through Megamax and Alcyon. It will also notify you of variables that have been declared but never used, violations of standard C rules concerning structures and unions, constant conditionals and data type confusions.

There's a switch that allows warnings of deviations from Kernighan and Ritchie. This is a simple warning with no further elaboration—it's up to you to look at the source code and figure out just what the violation is. As far as I could tell from testing, **MWC** does not check for the following: use of uninitialized variables; use of a value returned from a function that has no return statement (and which is not declared void—this situation is detected); statements which are unreachable for various reasons; statements with possibly confused operator precedences; and cases where too many or too few arguments are passed to a function.

Unless you specify otherwise, a source file is compiled and linked with one command. The linker can be run separately. Various compiler switches allow you to (among other things) define or undefine symbols on the command line, specify include files and libraries, generate assembly source code as output (instead of an object file), substitute other programs for various passes of the compiler(!), and allow nested comments in the source code. The preprocessor can be run separately (for example, to generate macros in assembly source code), and so can the assembler.

However, the letter combinations denoting compiler and linker switches are case-dependent. When you run the compiler as a .TTP application from the desktop, everything is translated into uppercase by the system, so that many of the options become inaccessible. Since one of these is the library (-l) option, this made the .TTP form effectively useless for me. However, there is enough room on a double-sided floppy to hold the command-shell program and the compiler, so you can run the latter in the normal way.

An easy-to-use archiver will create libraries from object files. A very useful utility called drtomw converts object files in DRI (i.e., Atari) format to **MWC** format. You can then link to these modules, as well. I have tested all these features, and they all work.

MWC provides bindings for all VDI and AES functions. However, the manual does not include GEM documentation.

Creating a desk accessory requires the following steps (not given in the manual): save a copy of crtsg.o (the normal GEM startup code) in a safe directory. Then assemble the following code, name it crtsg.o, and put it in the lib directory (see Figure 2).

After you've done this, compile with the -VGEM switch. The output should be a properly functioning desk accessory. The next release of the compiler will have a simple switch for creating accessories.

As I mentioned, the assembler can be used alone, but has its quirks. The assembler directives, data declaration and definition keywords are all nonstandard. The symbol for immediate data ($, the dollar sign) is not only nonstandard but an alias of the symbol Motorola uses to denote hexadecimal values. Register lists for the movem instruction aren't supported, so you'll either have to hand assemble your own mask values, or push and pull registers separately (making sure you preserve the right order). Within its limits, the assembler works fine. You can easily link to the object modules it generates, and you can also compile/assemble a C source and assembly source file at the same time, link it, and get a runnable program file—all with one command. There is no in-line assembly feature.

MWC includes many extensions and extra features. It's sometimes difficult to find them, though. Most of the manual (close to 400 pages) consists of the Lexicon, an alphabetical listing of every term, keyword, command or utility in the **MWC** system. There's an enormous amount of useful information in the Lexicon, much more than in most compiler manuals, and, for the most part, it is well organized. But there are, inevitably, omissions. Worse, nowhere in the manual can you find in one place a set of specifications for this implementation of C. Usually, you can look up the relevant topic, but in the case of identifier length and allowable characters, for example, I searched in vain. The section on the assembler gives this information (I assume it holds true for the compiler and external labels), but it isn't indexed. (It seems that all alphanumeric characters plus period (.) and baseline characters (_) are allowed in identifiers, and only the first sixteen are significant.)

The following seem to be the most significant extensions included in **MWC**: peek and poke statements (in byte, word and longword sizes); void as function and enum as data type; structure assignment, passing and returning structures (as opposed to pointers to structures) to and from functions; assert and #assert macro and directive, to check the values of variables and constants at compile and runtime (used in debugging); two sort routines (shellsort and quicksort), included in the function library; initialization of auto arrays; a Bessel library function; and some other miscellaneous math functions. Three address registers and five data registers are available for register variables in any function. If you let it, the compiler will warn you when it is reducing "register" storage class variables to "auto."

The license agreement at the back of the **MWC** manual states that no royalties or license fees are required for commercial programs developed with the package.

It's difficult to make a hard-and-fast choice between **MWC** and **Megamax C** as the C compiler to buy. For single users, especially those without a hard disk, **Megamax C** is probably best. It's much faster than anything else, and its elegant in-line assembler is a joy to use. Those for whom such issues as object-module compatibility with DRI code are important, and who have a hard disk, may well prefer **MWC**'s many extras. From that standpoint, Mark Williams' command shell with its many UNIX-like utilities and wide range of compiler and linker options make it, in my opinion, the all-round best choice for serious software development on the ST.

Figure 1.

```
/* subroutine to save/restore MMC base register   */
/* D0 == 0 => save A4, else restore A4            */
reg_a4:   bsr       fix_a4      ;figure out what to do
save_a4:  nop                   ;4 bytes empty space
          nop
fix_a4:   movea.l   (A7)+,A0    ;get address of 'save_a4'
          tst.l
          beq       store_a4    ;if save
get_a4:   movea.l   (A0),A6     ;else restore A4
          rts                   ;and return
store_a4: move.l    A4,(A0)     ;save A4
          rts                   ;and return
```

Figure 2.

```
      /The MWC version of "accstart.s"--
      .shri                     /shared instructions
      .globl    main_           /label of C program start
start:
      lea       estack,sp       /set top of stack
      jsr       main_           /begin program
      clr.w     -(sp)           /code == terminate process
      trap      $1              /GEMDOS call
      .bssd
ustack:   .blkw 1024            /space for stack == 1K
estack:   .blkl 1               /top of stack
```

Table 1.

Compiler/Linker Timings and File Sizes

Filename and sizes	.c	.prg	Floppy times	Hard times
DRI: apskel	(7259)	10774	C=3:58, L=3:43	C=2:12, L=1:55
sx	(6347)	14407	C=3:45, L=3:40	C=1:55, L=1:48
wwx	(42695)	21069	C=11:00, L=5:17	C=3:25, L=2:13
MMC: apskel	(8840)	5604	C=0:30, L=0:55	C=0:12, L=0:25
sx	(6330)	10153	C=0:23, L=1:05	C=0:09, L=0:30
wwx	(42664)	14397	C=1:01, L=1:28	C=0:27, L=0:35
MWC: apskel	(9126)	8219	C+L=3:45	C+L=1:05
sx	(6347)	14198	C+L=3:20	C+L=1:00
wwx	(42764)	20134	C+L=6:35	C+L=1:50

sx is a TOS file utility; wwx is a GEM windowing demo (see last month's **ST-Log**).
C=compile time, L=link time. Times in minutes:seconds.
File sizes in K bytes.
Hard disk used was 60MB Supra in 4 15MB partitions.
MWC floppy version was double-sided, DRI and **MMC** single-sided.

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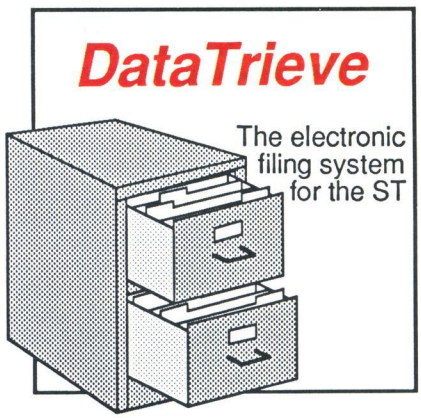

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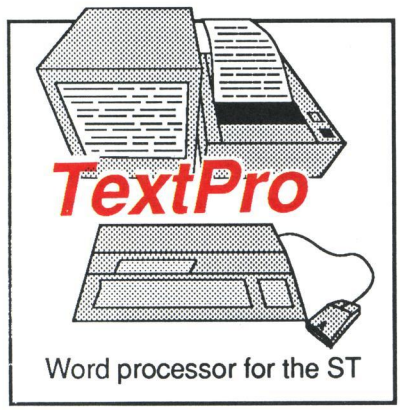

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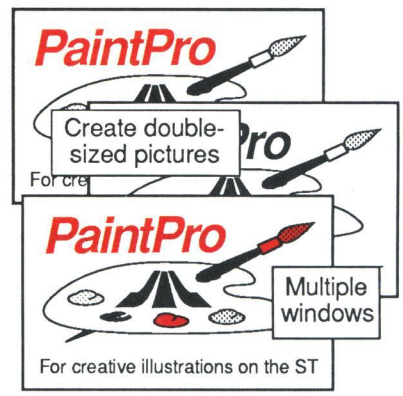

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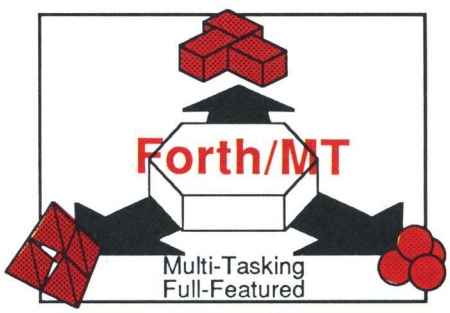

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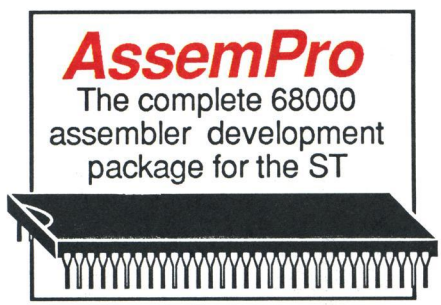

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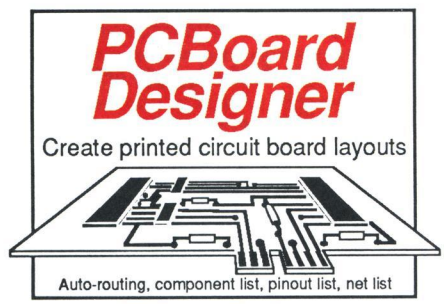

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Major Motion and Time Bandit

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by David Plotkin

While the ST is certainly more than just "another game machine," its capabilities and price make it outstanding in that category—when you finish all your word processing, spreadsheeting, etc. Software companies are starting to realize this, and games are becoming widely available. I admit to being an unabashed arcade-game lover (I've only solved two graphics/text adventures in my life), so the games reviewed here are for ST owners who still love a fast shoot-'em-up.

Monkey Business is a very thinly disguised clone of **Donkey Kong**. It's written by Ron Fortier, whose name you may recognize from such titles as **Bruce Lee** (DataSoft) on the 8-bit machines. It's not bad for a first effort, although it doesn't utilize many of the ST's features.

In **Monkey Business**, you play an IRS agent attempting to collect back taxes from "Mr. Big." I'll refrain from commenting on this story line; most of them are pretty dumb, anyway. You must negotiate your way from the bottom to the top on each of three screens, leaping over or avoiding obstacles to accomplish your objective. If you complete all the screens you start over, faster and with more obstacles.

The three screens are remarkably similar to those in **Donkey Kong**. The barrels are there, as are the girders and the "springs and elevators." The fourth screen is missing, however. Also missing is the sequence where the barrels catch fire and chase you. This makes the barrel screen very easy.

Monkey Business isn't a "polished" program. It suffers from jerky animation and sound quality similar to that of the Apple II. The animation is jerky due to the lack of enough intermediate figures. For example, the ape has only three positions—left, center and right. Also, the supposedly fierce hounds on the girder screen resemble innocent beagles! Despite all this, the game is playable. The skill required rises just enough on each level to keep it interesting. If you're a **Donkey Kong** fan, this is the only game in town.

Don't kill the bystanders in *Major Motion*.

Delta Patrol, also from The Other Valley Software, is a game wherein you pilot a helicopter across a scrolling landscape, shooting the descending aliens to prevent the destruction of your refueling dumps. There's a marked similarity to both **Defender** and **Choplifter**.

Your joystick controls the chopper, which carries an umlimited supply of ammunition. You shoot at the aliens descending from the top of the screen, dropping bombs on your many refueling dumps. These dumps are periodically rebuilt by a little dune buggy, so running out of fuel isn't as big a problem as avoiding collisions with a screenful of aliens—who come at you in ever-increasing numbers. As the levels increase progress, more and faster aliens appear, along with new types, which even shoot back! A radar screen at the bottom of the display informs you of the attacking aliens' whereabouts.

Delta Patrol has some cute touches. The fuel dumps are little gas stations, complete with signs for donuts. The aliens themselves are amusingly designed, using bright colors. All screen motion is smooth. Finally, your chopper kicks up clouds of dust when it gets close to the ground.

Delta Patrol is a simple game with few variations. As such, it may lose its appeal after a short while. Like **Monkey Business**, this game leaves virtually untapped the graphics and sound capabilities of the ST, as well as its huge programming space. **Delta Patrol** will leave the adult arcader looking for other challenges.

A worthwhile challenge to turn to is MichTron's **Major Motion**. Based on the arcade classic **Spy-hunter**, it has you using your mouse to guide a car down a vertically-scrolling road, doing battle with all manner of enemy vehicles—while attempting not to injure innocent bystanders or run off the road. Kill too many innocent civilians, and you'll be demolished—by a fighter plane.

Your car is initially armed with just machine guns. You may use the guns to obliterate your enemies, or attempt to run them off the road by ramming them. Since many

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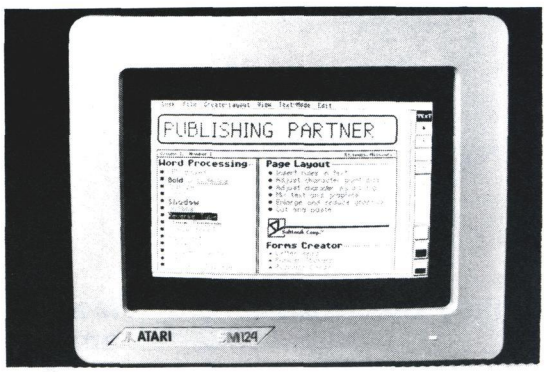

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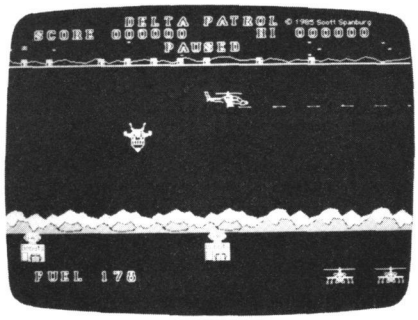
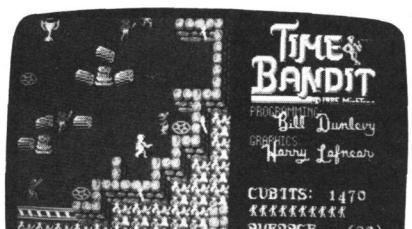
of the enemy vehicles are armored against your guns—and are also bigger than you are—outrunning them is often the best strategy. Periodically, a weapons van appears which can arm your car with additional defenses. These include a smoke screen, oil (to cause skids), a super impulse device (for knocking other cars off the road), and a missile launcher to use against the chopper. The added weapons are activated via the keyboard.



Protect the refueling stations in *Delta Patrol*, from your 'copter.

This is a tough game! The weapons van appears at the most inopportune times, and can get in the way. Unlike the arcade version, you can't destroy it to get it out of the way. Docking with the van can be tricky if you're surrounded by enemy vehicles. Often the van will drop you back on the road alongside a tire-slashing enemy car. The van blocks your way so you can't run, giving the enemy a chance to destroy your car. This can be exceedingly frustrating.

The fact that **Major Motion** can only be played with a mouse also detracts, since I find myself running out of desk space at the worst times. A joystick mode would improve this game quite a bit. On the positive side, **Major Motion** allows you to redefine the weapons keys if the default keys aren't convenient, and maintains a high score on disk.



***Time Bandit*.**

Overall, **Major Motion** is a good game, provided you don't have a low frustration factor. It features good graphics and sound, and nonstop excitement. The limitations of your car force you to plan carefully before running the next gauntlet of enemy cars. And look out for that chopper!

I've saved the best for last. MichTron's **Time Bandit** is billed on the box as "the ultimate arcade game." Of course, software packaging will never win a prize for truth in advertising—except this time. **Time Bandit** represents a truly outstanding feat—an arcade game with action, variety, attention to detail and fantastic graphics. Harry Lafnear and Bill Dunlevy (the authors) can be proud of this one.

Time Bandit opens on a scrolling landscape dotted with small structures. Castles, houses, a spaceship and a pyramid are just some of the items you'll find. Guiding your alter-ego into any of these icons opens up a new world. While these microworlds are similar in many ways, they present a new and different challenge to the arcader. Each of the microworlds is split into sixteen levels, from 1A to 4D. The object is to enter the microworld, battle your way to a variety of treasures, recover keys and, finally, unlock the way out. Each time you re-enter a microworld, the level goes up (from 1A to 1B, etc.), with a major jump in difficulty between numbered levels.

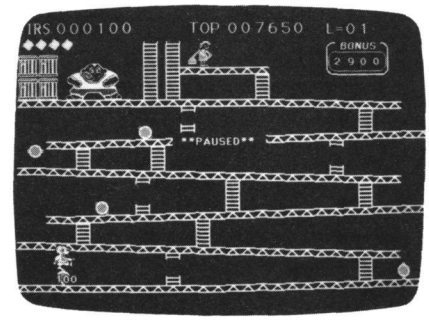
And what a battle you'll fight! Use your joystick to move and shoot your guns, while hounded by multitudes of evil creatures which inhabit the mazelike microworlds. The beings spring from special points located throughout the maze (don't stand on these points). Their touch costs you one life, and they'll follow you—even shoot at you—in the higher levels.

The maze in each microworld is different, and even shifts between levels, increasing the need for memory skills. The points you receive for each creature you destroy depend on how much you move. If you stand in one place, just blowing away attacking enemies, your points-per-creature count will drop to zero.

Time Bandit is full of surprises, which I won't spoil for you. But try the **Pac-Man** maze, and enter the subterranean chamber below the arena. The starship features a difficult text adventure (sit down at the computer consoles), and there's even a quest to recover the lost crown of a king—in return for a king's ransom in gold. Watch out for the wandering spaceships on the main screen, which will throw you into a microworld chosen at random. And read the signs scattered throughout this game; they can be very helpful.

Time Bandit is an example of the ST's capabilities in the game-playing department. The screen abounds with color, and small details are animated to good effect. Such things as flags waving on the castle ramparts and blinking lights on the starship *Excalibur* add a lot to the game. But this game especially shines in its animation. Each microworld features different sets of creatures, from the lions and trolls of the arena, to the roving snakes and eye balls of the pyramid. These creatures move smoothly and are convincingly animated. Even the manner in which they disintegrate when hit is well done. For example, shooting a ghost causes it to appear in a "No Ghosts" symbol (from *Ghostbusters*) for a brief instant before disappearing. The variety of demises is another example of the imagination that went into this game.

Time Bandit is different; it's unlikely that you could ever finish every microworld



You're an IRS agent in *Monkey Business*.

through all sixteen levels. The authors don't believe it can be done, either. I play to see how far I can get in each structure before running out of lives. This way, each microworld becomes a separate arcade game, making this a good value for your software dollar.

High scores are saved to disk. I'd like to meet Krazy Kev, the fiend who put the high score on my disk—over 500,000 points (I've gotten about 50,000). If you plan to buy just one arcade game for your ST, this has to be it. **Time Bandit** is superb—there's no other word for it.

David Plotkin owns an 130XE and a 520ST, and is currently a heavy Pascal user on the ST. His computer interests lie in programming, games and tutorials.

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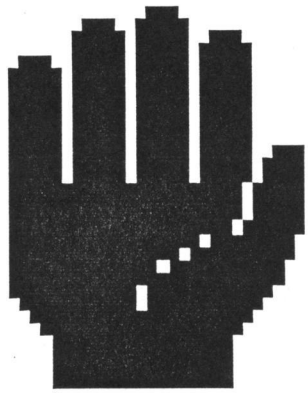

Alert boxes from ST BASIC

A subroutine and tutorial to get you the help you need, when you need it.

by Matheu Spolin

One of the most useful features of the ST's GEM system is the ability to call alert boxes—forms that appear in the middle of the screen, displaying a question, with several buttons for input. But, if you've read through the *ST BASIC Sourcebook* in an effort to find a Form_Alert_Box command, your search has been in vain. To the casual user, there seems to be no way to call up alert boxes in ST BASIC.

Not so. Now, with BOXFORM, the subroutine presented here, calling alert boxes—of all sizes—is only a matter of defining a string, setting some parameters and calling the subroutine.

BOXFORM uses the powerful basic command GEMSYS to call AES routine 52, known as FORM_ALERT. This routine not only creates the alert box and gets input from it, but also closes the box and restores the former screen display.

Using BOXFORM.

To see BOXFORM in action, type in Listing 1 (in ST BASIC). If you're using TOS from disk, you may have to disable buffered graphics to employ the program. Lines 10 through 400 are part of the demo. They aren't needed to use BOXFORM in your own programs. The actual subroutine begins at Line 63000.

To put BOXFORM into your own programs, you must define BOX$ with the text you would like to appear in the box. To separate lines of text within the string, use the logical OR character (|). This character is produced by striking the backslash character (\) while holding down SHIFT.

Next, the buttons you'd like to have appear in the box must be assigned to the variable BUTTON$. Separate the button labels as you would lines of text, with the logical OR character (|).

After that, you must store the icon number in the variable *ICON*. The exclamation point, question mark and stop sign icons are numbered *1*, *2* and *3*, respectively. If no icon is desired, store a *0* in the variable.

Defining the variable PRIORITY is optional. It contains the number of the button to thicken, indicating that option may be selected by pressing RETURN. If you don't assign a number to PRIORITY, no button is highlighted.

After defining these variables, simply GOSUB BOXFORM. The subroutine will create an alert box, display it on the screen, read the input, then return to the main program's control. The button number which the user selected will be stored in the variable KEYCHOICE, upon return to the main program.

BOXFORM is an easy to use subroutine for creating alert boxes in any ST BASIC program. However, as with any call to GEM, passing the wrong parameters will cause ST BASIC to crash. So check your parameters carefully. Don't use any square bracket characters in your strings, and don't make any text line in BOX$ over twenty characters.

Also, please remember that alert boxes can hold no more than three buttons. Defining a fourth will send your ST into never-never land.

Matheu Spolin has been writing computer programs for six years and works in BASIC, Action!, C and 6502 assembly language. He currently enjoys writing programs on his 520ST, while his 130XE runs his bulletin board system, the Towers of Darkness BBS, at (301) 656-3401.

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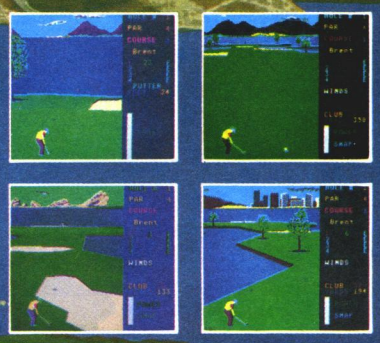

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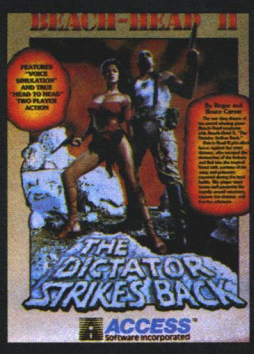

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//Alert boxes *continued*

Listing 1.
ST BASIC listing.

```
10 ' BOXFORM.BAS By Mathew Spolin
20 '
30 '
40 ' *** DEMO PROGRAM DRIVER ***
50 CLEARW 2:FULLW 2
60 COLOR 1,3:FILL 0,0
70 BOX$="Welcome to BOXFORM|By Mathew
Spolin"
80 BUTTON$="OK|Not OK"
90 ICON=2:PRIORITY=1
100 GOSUB BOXFORM
110 ON KEYCHOICE GOTO 120,170
120 BOX$="Im glad it's OK.|Aren't you?
"
130 BUTTON$="You Bet|No Way"
140 ICON=3:PRIORITY=0
150 GOSUB BOXFORM
160 ON KEYCHOICE GOTO 220,240
170 BOX$="Oh. That's too bad."
180 BUTTON$="Continue"
190 ICON=0:PRIORITY=1
200 GOSUB BOXFORM
210 GOTO 280
220 BOX$="That's great."
230 GOTO 250
240 BOX$="Oh well..."
250 BUTTON$="Continue"
260 ICON=1:PRIORITY=1
270 GOSUB BOXFORM
280 BOX$="Choose next operation"
290 BUTTON$="BASIC|DESKTOP|RUN THIS"
300 ICON=3:PRIORITY=3
310 GOSUB BOXFORM
320 IF KEYCHOICE=1 THEN END
330 IF KEYCHOICE=2 THEN 350
340 IF KEYCHOICE=3 THEN 30
350 BOX$="Please type QUIT at|the OK p
rompt"
360 BUTTON$="I'll do that"
370 ICON=1:PRIORITY=1
380 GOSUB BOXFORM
390 END
63000 BOXFORM:' Subroutine to make ale
rt box
63010 BOX2$=STR$(ICON)+"][|"+BOX$+"|][
"+BUTTON$+"]"
63015 BOX$=BOX2$
63020 A#=GB:GINTIN=PEEK(A#+8):GINTOUT=
PEEK(A#+12)
63030 N#=PEEK(A#+16):POKE GINTIN,PRIOR
ITY
63040 POKE N#,VARPTR(BOX2$)
63050 GEMSYS(52):KEYCHOICE=PEEK(GINTOU
T)
63060 RETURN
```

●

ST CHECKSUM DATA.
(see page 56ST)

```
 10 data  340, 450, 356, 735, 464, 535
, 288, 87, 764, 334, 4353
 110 data  511, 820, 161, 799, 349, 52
4, 251, 278, 809, 336, 4838
 210 data  404, 450, 401, 771, 271, 80
4, 357, 261, 105, 794, 4618
 310 data  341, 508, 381, 322, 130, 92
1, 809, 362, 806, 962, 5542
 63010 data  433, 920, 43, 273, 277, 3
01, 542, 2789
```

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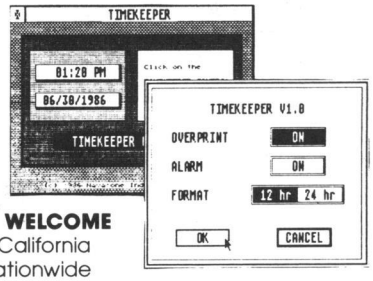

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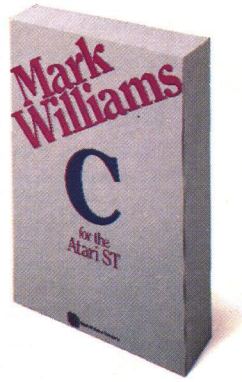

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by Matthew J.W. Ratcliff

Modems are becoming very common, now that they're so affordable. They can be used to call up CompuServe or Delphi, where you can access a whole world of information—for a fee, of course. There are many "computaholics" (as I affectionately call them, myself included) who set up their own computer systems, with modems and dedicated phone lines, in the form of a Bulletin Board System (BBS). Most often, these are free. On a BBS, you may find files you can "download" from their computer to yours. You can actually receive public domain programs directly over the phone, with a modem and the proper software. Often, such a BBS has several topical message bases and on-line experts who can answer your technical questions.

The **SmarTEAM** 300/1200-baud modem is an affordable alternative to the Hayes **Smartmodem**, the standard by which others are judged. The **SmarTEAM** can operate at 300 or 1200 baud (bits per second). Most modems send 1 "start bit," 1 "stop bit" and 8 bits per character. That means you can transfer 30 characters of information per second at 300 baud, 120 at 1200 baud. Not all BBSs support 1200 baud these days, but those that do will save you a great deal of time when transferring program files.

At four times the usual transfer speed, 1200 baud will be desirable for calling information services, to minimize chargeable connect time. Although CompuServe has a surcharge for 1200 baud, it's less than twice as much as the 300-baud fee. Delphi has no surcharge for 1200- or even 2400-baud rates. Enough tutorial, now on to the **SmarTEAM** specifics.

The spiral bound manual is readable and covers all the "smart" commands for modem control. There's even a handy pocket reference guide. Considering all the "Hayes-compatible" advertising for the **SmarTEAM**, I found it odd that there was *no* mention of this compatibility in the manual.

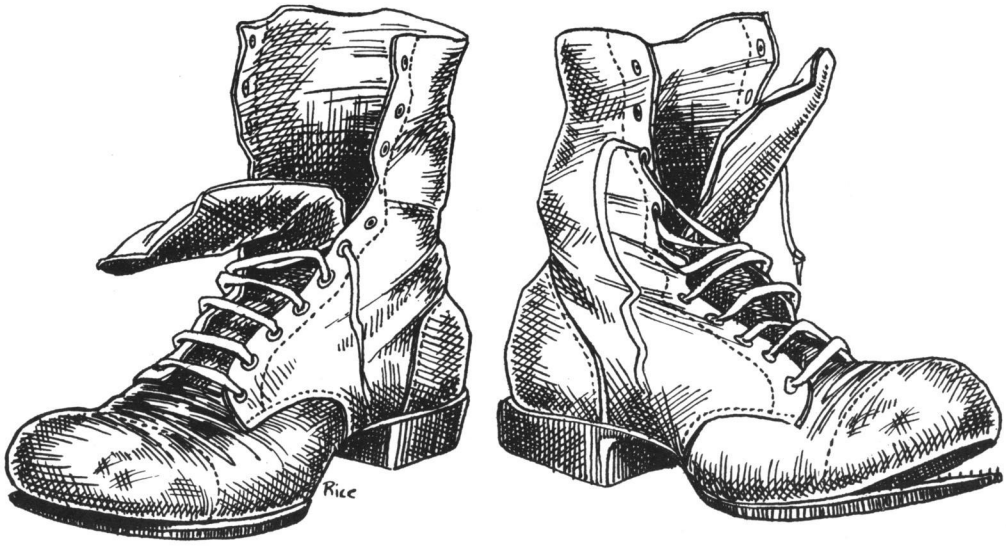
Noting the huge price difference between the **SmarTEAM** and the Hayes, I *expected* less quality in performance. I first hooked up the **SmarTEAM** to my 130XE system, equipped with an 850 interface. I used a cable originally made for a different modem, and it worked fine. I called several local BBSs and a long-distance one. The modem performed flawlessly, at 300 and 1200 baud. All the Xmodem file transfers worked fine.

Next came the *acid* test: we put the modem on Gateway City BBS. I gave the **SmarTEAM** to SYSOP Jim without any documentation—intentionally, as part of the compatibility test. Jim called a friend who owned a Hayes and duplicated his switch settings. The **SmarTEAM** was then put on-line, in place of the old faithful Hayes 300. It worked the first time, as we would have expected a Hayes to. This proved its Hayes compatibility to our satisfaction. (We were running FoRem XL BBS software.)

Then the *problem* cropped up. Occasionally, while on-line, I would get a garbage character echoed back to me. Other Gateway users indicated having the same problem, at both 300 and 1200 baud. Sometimes this happened while entering a message. I would go back to the line with the garbled character, to edit it out. However, the line would list with no errors. Apparently, the modem received the character properly, but echoed it incorrectly.

We sent the **SmarTEAM** back to ICD, and they replaced it promptly. The next **SmarTEAM** exhibited the same symptom. Just to be sure it *wasn't* the phone line, we put the **SmarTEAM** on the M.I.C.E. BBS for a couple of days. We put the M.I.C.E. 300/1200 Hayes on Gateway, in the meantime. The echo problem immediately showed up on the M.I.C.E. BBS when the **SmarTEAM** went on-line. These BBSs, when running on a Hayes, have never exhibited such anomalies.

Considering the major price advantage over the Hayes, I think the **SmarTEAM** would make an excellent personal modem (where the above problem would not occur). For a BBS, you may have some minor problems. The garbled characters are occasional (maybe 1 byte in 4K) and have not caused any problems in uploading or downloading files. (The Xmodem file transfer protocol automatically retries on errors.) This minor nuisance would never occur with a Hayes, but you pay a premium for it. The **SmarTEAM** is a good modem for the price, but—to put it simply—it's not a Hayes.



by Karl E. Wiegers

When the Atari 400s and 800s first hit the market, the magic word was *graphics*, more specifically, *player/missile graphics*. You probably learned how to create and animate players in BASIC programs—and have observed that it's a bit cumbersome. Now, we'll see how to do the same thing in assembly language. It really isn't hard at all.

In the last two issues, we created the title screen for "Attack of the Suicidal Road-Racing Aliens," then jazzed it up with some display list interrupts. This time we move on to an actual playing screen, with an alien and a car dashing about. Unfortunately, they're all alone on a blank screen, and their movement is monotonous.

That's the way the tutorial crumbles for this month. In the next two issues, we'll build on this simple player action and get considerably more sophisticated. Be sure to enter this month's listing with the line numbers shown, since we'll be merging additional code with this program in the next two issues.

We really aren't going to create a complete, playable game with this stepwise process. Instead, I'll present the elements of a game, to illustrate the programming techniques involved. If you do want to put the pieces together, just keep adding code at the end of last month's program, rather than starting today's program at the $5000 address. Also, you'll have to fix the routine for detecting the START button from last time, so that execution continues with the first line of today's program.

PMG primer.

First, a quick refresher on player/missile graphics (PMG). The background screen display is referred to as the "playfield." A "player" is simply an 8-pixel-wide stripe of dots that runs the full vertical height of the screen. We can selectively turn on whichever dots we want, and superimpose the resulting figure on the playfield. A control register in the operating system lets us select whether a player or a playfield object appears to be "in front" whenever they occupy the same space. Other registers allow us to check for collisions between players and playfield objects.

A "missile" is a 2-pixel-wide analog to a player. The Atari can have up to four players (and their missiles) present on-screen at once. Each player/missile combination has its own color register, but a missile is always the same color as the player with which it's associated. We can double or quadruple the width of each player independently, making them 16 or 32 pixels wide. Other PMG control registers set the horizontal positions of the players and missiles on the screen.

Players can be defined as having either "single-line" or "double-line" vertical resolution. In single-line resolution, the player stripe is 256 pixels (scan lines) high. A double-resolution player is 128 pixels high, where each pixel occupies two scan lines. All players must have the same resolution. Naturally, single-line resolution permits finer detail in the player dot pattern. The price you pay is in memory: single-line resolution requires twice as many bytes of storage as double-line.

Getting started.

The first task when setting up a PMG display is to decide what you want your players to look like. I'll assume you're familiar with the technique of defining a player shape by deciding which of the eight dots in each line are to be illuminated, and computing a numeric byte value from the binary pattern that results. Many good articles on PMG fundamentals can be found in Atari literature. There are also many good programs available (commer-

Boot Camp

cially, and in magazines or books) to help you design your players.

As with most assembly programs, the next step is to allocate memory. Double-line resolution requires 1024 bytes of RAM, and single-line resolution requires 2048 bytes. The starting byte of the RAM allocated to PMG (called PMBASE) must be on a 1K boundary for double-line resolution, and on a 2K boundary for single-line. I usually use single-line resolution starting at address $3000. The PMG region will thus extend up to address $37FF.

Table 1.
Usage of the RAM block allocated to player/missile graphics, in bytes offset from PMBASE.

Function	Double-Line Resolution	Single-Line Resolution
Unused	0 - 383	0 - 767
Missiles	384 - 511	768 - 1023
Player 0	512 - 639	1024 - 1279
Player 1	640 - 767	1280 - 1535
Player 2	768 - 895	1536 - 1791
Player 3	896 - 1023	1792 - 2047

Table 1 shows how the PMG RAM is used. In single-line resolution, one page (256 bytes) is used for each of the four players and a fifth page is for the four missiles (64 bytes each). This leaves the block from byte 0 of the PMG RAM through byte 767 empty and available for your use. The location of the player within its allocated RAM section determines its vertical screen position.

I alluded to the various registers used to control PMG functions. Table 2 lists the important ones for today. Notice in Table 2 that there are registers for the horizontal positions of players, but not for their vertical positions. We'll discuss the significance of this fact later on. Now, turn your attention to the assembly listing and we'll see how it's done.

Table 2.
Important PMG registers.

Name	Hex Address	Function
SDMCTL	$022F	62 for single-line, 46 for double-line resolution
PCOLR0-3	$02C0-$02C3	color of players 0-3
HPOSP0-3	$D000-$D003	horizontal positions of players 0-3
SIZEP0-3	$D008-$D00B	player size: 0=normal, 2=double, 3=quadruple
GRACTL	$D01D	store 3 to enable PMG, 0 to disable
PMBASE	$D407	store high byte of PMBASE here

Example: an alien and his car.

This month's sample program illustrates how to implement player/missile graphics and how to move players vertically and horizontally under program (as opposed to user) control. The program employs two players: an alien who moves up and down, and a car that moves from left to right.

The listing begins with the familiar CIO equates. All we'll do with CIO is open the screen in graphics mode 3 and leave it blank. Lines 350-430 contain the equates for the PMG registers in Table 2. Some other variables I use in the program are defined in Lines 470-560. SHAPE and PLYRSTRT are 2-byte variables placed in some of the few free 0-page bytes. I'll use these for some loads and stores, with the 6502's indirect indexed addressing mode. I set aside a block of 4 bytes to keep track of the Y-positions of the four players (YPOSP0), and another block for the X-positions (XPOSP0). NBYTES is the number of bytes of shape data in the player currently being manipulated.

Sometimes you may want to confine the movement of

your players to a certain area on-screen. In this example, I want the alien to hang around between specified vertical limits. Hence, the variables TOP and BOTTOM, which will be loaded with the scan lines of my upper and lower movement limits. Finally, DIRECT is used to keep track of which way the alien is moving, up *(1)* or down *(0)*. I tend to use page 6 for this sort of variable storage, but you can put your variables anyplace where they'll remain intact.

I'm using single-line resolution, so I must locate PMBASE on a 2K boundary (hex addresses of $X000 or $X800). Line 620 shows that the PMG region begins at address $3000. The program itself begins at address $5000, as is my habit; execute this program at address $5000.

Recall that only pages 4-8 of the PMG RAM block contain information that'll be shown on the screen. Lines 1910-2000 of the listing zero all the bytes in those five pages, thus preventing any extraneous junk in that section of RAM from affecting the screen display.

The high byte of the first byte of the PMG block must be stored into the register called PMBASE ($D407), as in Lines 2010-2020. Lines 2030-2100 initialize the player sizes and horizontal positions to *0*.

The player shapes themselves are found in Lines 4920-4950 and 5210-5240. Player 0 is the alien, and player 1 is a car. I decided to store these data tables in the unused portion of the PMG block. The alien shape is at the beginning of the PMG block ($3000), and the car immediately thereafter.

The first byte in each table is the number of bytes of actual player shape data. The alien shape contains 14 bytes, the car 15. This means the alien is 14 scan lines high and the car is 15 lines. The remaining bytes are the decimal values of the bit patterns for each line of the player shape. The last byte in each player is a *0*, which doesn't contribute to the appearance of the player, but helps with vertical movement (as we'll see shortly).

Now that memory's been allocated, we need to copy the player shapes into the correct page of the PMG RAM block. Of course, we could have put them in the right place initially. But sometimes you want to have multiple shapes for a single player, (having an alien face to the left, to the right, forward, or backward). In such cases, the various player shapes all have to be stored somewhere, and you must copy them to the right part of the PMG block whenever you want to change the shape. I've primed your mind for this technique by storing the shapes in the free PMG area. (This trick resurfaces in a couple of months).

The code in Lines 2140-2250 copies the data for the alien into a specified portion of the RAM block for player 0. Line 2190 indicates that this block is four pages higher in RAM than the start of the PMG block. Line 2220 sets the initial vertical position of the alien at scan line 180, by storing the player data at an offset of 180 bytes from the beginning of the allocated RAM page. I also store this vertical position in variable YPOSP0, to keep track of where the little guy is. Feel free to play with this number and see what happens.

The subroutine called COPYPLAYER (Lines 3900-4020) actually performs the copy of the player data (how about that). By writing this segment as a subroutine, I can use it to copy *any* player data into *any* player RAM area. The car shape data is copied the same way in Lines 2300-2410, with an initial vertical position of 122. Finally, Line 2420 opens the screen using a familiar subroutine (OPENSCREEN, Lines 3350-3480) in graphics mode 3.

Lines 2460-2490 set the alien's upper and lower limits of movement. The upper vertical position where a player's still visible at the top of the screen is about 32 for single-line resolution, 16 for double. At the other extreme, vertical positions larger than about 224 (single) or 112 (double) will make the player fall off the bottom of the TV. Lines 2540-2570 make the alien yellow and the car purple. Notice that player colors are controlled with special registers PCOLR0-3, separate from the playfield color registers.

Now for the lowdown on the other critical PMG registers. Last month, we learned that location SDMCTL ($22F) controls whether the screen display is off (store a *0*) or on (store a decimal *34*). This register also controls whether the players are double-line resolution (decimal *46*) or single-line (decimal *62*). Lines 2580-2590 request single-line resolution players.

The horizontal size of players is controlled by the registers called SIZEP0-3 ($D008-D00B). Storing a *0* in one of these registers gives the default (normal) width of 8 pixels. Store *1* for a double-wide and *3* for a quadruple-wide player. Lines 2600-2610 make the car double width. The register called GRACTL ($D01D) enables player/missile graphics. Store a *1* to turn on the missiles, a *2* to turn on players and a *3* for both, as we do in Lines 2620-2630.

The horizontal position of players is dictated by the contents of registers HPOSP0-3 ($D000-D003). Allowable values are *0* to *255*, but positions below about 48 (left) and above about 208 (right) will be outside the boundaries of the TV screen. In Lines 2640-2650, we place the alien near the center of the screen. Since the HPOSP0-3 registers are write-only, I've created a second block of storage locations called XPOSP0-3, in case I need to find out where a player is at any given moment. Last but not least in this section, Lines 2670-2680 set the initial direction of alien movement as upward.

Now for some animation. Recall that we want the alien to move up and down, and the car to move horizontally across the screen. Occasionally, they may have an encounter session. In a future column, we'll see how to detect collisions among players and take some appropriate action. For now, though, let's just get the rudiments of player motion down pat.

The routine labeled *ACTION*, beginning at Line 2740, starts with a yawn by calling the subroutine DELAY (Lines 4080-4150). This subroutine does. . .absolutely nothing. Nonetheless, it's useful. If we let the players move around at top computer speed, things would be far too fast to follow. The delay subroutine simply loops for a number of cycles controlled by the contents of the X-register when DELAY is called. Line 2750 uses a value of *15* in X, but try different numbers and see what happens.

After that ever-so-brief pause, the car (player 1) is moved 1 pixel to the right, thanks to the instructions in Lines 2770-2790. Since this process goes on forever, the car will simply zip from left to right over and over again. Lines 2800-2850 prime the system for vertical movement of the alien (player 0).

Unfortunately, moving a player up and down isn't as simple as moving him left and right. Recall that the vertical orientation of a player reflects a pattern of bytes stored in a particular section of RAM. To move a player up one line, we must shift each byte of the player shape data 1 byte *lower* in RAM. Conversely, moving data bytes *higher* in RAM causes the player to move down the screen.

There are several ways to do this. One is to simply copy the player shape from its original storage location into the new desired position in the PMG block, making certain to zero out the old position so no extraneous player parts are visible. A second method is to actually shift the player shape 1 byte at a time within the RAM block. That's the approach I used in this example.

A certain amount of program logic is required to move the alien, as found in Lines 2900-3120. In short, we move the alien up if he's already going up and isn't yet at the top. If he's at the top, we start moving him down, until he reaches the bottom. Back and forth he goes, where he stops only the pusher of the RESET key knows.

Vertical movement is accomplished with subroutines MOVEDOWN (Line 4200) and MOVEUP (Line 4350). I think you can see how these routines simply shift the player data 1 byte in the appropriate direction. What would happen if we didn't have limits on the vertical movement area? Eventually the alien, player 0, would be moved into the section of RAM reserved for player 1, or into the block set aside for the missiles. Either way it's bad news, so I like to set the limits and worry about it no further.

Things to come.

As the alien mimics a yo-yo and the car flashes by, you'll see an occasional flicker or jump in the animation. This jerkiness is particularly noticeable at slow speeds (long delay set in Line 2750).

The fix to this is simple: move all your players while the TV gun is turned off, every sixtieth of a second. To accomplish this feat, we must create a "vertical blank interrupt" (VBI) routine, which gives us flicker-free motion.

Next time, we'll write a VBI that lets you move the alien around the screen via a joystick. I'll throw in a bonus: a procedure for using the VBI in a BASIC program.

Listing 1.
Assembly listing.

```
0100 ;Player/missile graphics example
0110 ;
0120 ;by Karl E. Wiegers
0130 ;
0140     .OPT NO LIST
0150 ;
0160 OPEN =  $03
0240 ICCOM = $0342
0250 ICBAL = $0344
0260 ICBLL = $0348
0270 ICAX1 = $034A
0280 ICAX2 = $034B
0290 CIOV =  $E456
0320 ;
0330 ;PMG-related equates
0340 ;
0350 PCOLR0 = $02C0
0360 SDMCTL = $022F
0370 HPOSP0 = $D000
0390 SIZEP0 = $D008
0410 GRACTL = $D01D
0430 PMBASE = $D407
0440 ;
0450 ;some variables I need to use
0460 ;
0470 SHAPE = $CB
0480 PLYRSTRT = $CD
0490 YPOSP0 = $0630
0500 XPOSP0 = $0634
0510 NBYTES = $0638
0520 TOP =   $0639
0530 BOTTOM = $063A
0560 DIRECT = $063D
0570 ;
0580 ;PMG area of 2K begins at $3000;
0590 ;player images are stored in
0600 ;unused part of PMG area
0610 ;
0620 PMG =   $3000
0630 ;
1850 ;*******************************
1860 ;  MAIN PROGRAM STARTS HERE
1870 ;*******************************
1880 ;
1890     *=  $5000
1900     CLD          ;binary mode
1910     LDX #0
1920     TXA
1930 INIT1
1940     STA PMG+$0300,X ;zero out
1950     STA PMG+$0400,X ;player and
1960     STA PMG+$0500,X ;missile
1970     STA PMG+$0600,X ;parts of
1980     STA PMG+$0700,X ;PMG area
1990     INX
2000     BNE INIT1
2010     LDA #PMG/256 ;store address
2020     STA PMBASE  ;of PMG area
2030     LDA #0
2040     LDX #3
2050 INIT2
2060     STA SIZEP0,X ;zero sizes,
2070     STA HPOSP0,X ;horizontal
2080     STA XPOSP0,X ;positions
2090     DEX          ;for all
2100     BNE INIT2    ;players
2110 ;
2120 ;load alien shape into player 0
2130 ;
2140     LDA #ALIEN&255 ;store address
2150     STA SHAPE   ;of shape in
2160     LDA #ALIEN/256 ;page 0 bytes
2170     STA SHAPE+1
2180     CLC
2190     LDA #$04    ;store address
2200     ADC #PMG/256 ;where player
2210     STA PLYRSTRT+1 ;is to be
2220     LDA #180    ;stored into
2230     STA PLYRSTRT ;page 0 bytes
2240     STA YPOSP0  ;and variable
2250     JSR COPYPLAYER ;store image
2260 ;
2270 ;load car shape into player 1
2280 ;the same way as the alien
2290 ;
2300     LDA #CAR&255
2310     STA SHAPE
2320     LDA #CAR/256
2330     STA SHAPE+1
2340     CLC
2350     LDA #$05
```

```
2360      ADC #PMG/256
2370      STA PLYRSTRT+1
2380      LDA #122
2390      STA PLYRSTRT
2400      STA YPOSP0+1
2410      JSR COPYPLAYER
2420      JSR OPENSCREEN ;open screen
2430 ;
2440 ;set up PMG environment
2450 ;
2460      LDA #30       ;top of alien
2470      STA TOP       ;movement area.
2480      LDA #200      ;bottom of alien
2490      STA BOTTOM    ;movement area.
2540      LDA #28       ;alien is yellow
2550      STA PCOLR0
2560      LDA #86       ;car is purple
2570      STA PCOLR0+1
2580      LDA #62       ;single-line PMG
2590      STA SDMCTL    ;resolution
2600      LDA #1        ;car is double
2610      STA SIZEP0+1  ;wide
2620      LDA #3        ;enable PMG
2630      STA GRACTL
2640      LDA #120      ;alien starts in
2650      STA HPOSP0    ;middle of screen
2660      STA XPOSP0
2670      LDA #1        ;initial direc-
2680      STA DIRECT    ;tion is up
2690 ;
2700 ;commence player movement;
2710 ;alien moves only vertically,
2720 ;car moves only horizontally
2730 ;
2740 ACTION
2750      LDX #15       ;do nothing
2760      JSR DELAY     ;for a bit
2770      INC XPOSP0+1  ;move car 1
2780      LDA XPOSP0+1  ;position to
2790      STA HPOSP0+1  ;the right
2800      CLC
2810      LDA #$04      ;store initial
2820      ADC #PMG/256  ;RAM position
2830      STA PLYRSTRT+1 ;of alien in
2840      LDA YPOSP0    ;page 0 bytes
2850      STA PLYRSTRT
2860 ;
2870 ;logic to figure out if alien is
2880 ;be moved up or down
2890 ;
2900      LDA DIRECT    ;current dir
2910      BNE CHKTOP    ;up, check top
2920 CHKBOT
2930      LDA YPOSP0    ;is he at the
2940      CMP BOTTOM    ;bottom?
2950      BEQ UP        ;yes, move up
2960      BNE DOWN      ;no, move down
2970 CHKTOP
2980      LDA YPOSP0    ;is he at the
2990      CMP TOP       ;top?
3000      BNE UP        ;no, move up
3010 DOWN
3020      JSR MOVEDOWN  ;move him down
3030      LDA #0        ;current direc-
3040      STA DIRECT    ;tion is down
3050      CLC           ;keep going
3060      BCC ACTION
3070 UP
3080      JSR MOVEUP    ;move him up
3090      LDA #1        ;current direc-
3100      STA DIRECT    ;tion is up
3110      CLC           ;keep going
3120      BCC ACTION
3240 ;*****************************
3250 ;     END OF MAIN PROGRAM
3260 ;*****************************
3270 ;
3280 ;
3290 ;*****************************
```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```
3300 ;SUBROUTINES START HERE
3310 ;*****************************
3320 ;
3330 ;open screen in Graphics 3
3340 ;
3350 OPENSCREEN
3360     LDX #$60
3370     LDA #OPEN
3380     STA ICCOM,X
3390     LDA #SCREEN&255
3400     STA ICBAL,X
3410     LDA #SCREEN/256
3420     STA ICBAL+1,X
3430     LDA #12
3440     STA ICAX1,X
3450     LDA #3
3460     STA ICAX2,X
3470     JSR CIOV
3480     RTS
3490 ;
3870 ;copy player from data region
3880 ;to desired PMG location
3890 ;
3900 COPYPLAYER
3910     LDY #0      ;get no. of
3920     LDA (SHAPE),Y ;bytes of
3930     STA NBYTES  ;player data
3940     INC NBYTES  ;to be moved
3950     LDY #1
3960 PLOOP
3970     LDA (SHAPE),Y ;copy to PMG
3980     STA (PLYRSTRT),Y ;area
3990     INY         ;data area
4000     CPY NBYTES  ;all bytes yet?
4010     BNE PLOOP   ;no, keep going
4020     RTS         ;yes, stop
4030 ;
4040 ;do-nothing delay subroutine
4050 ;number in X-register determines
4060 ;length of delay
4070 ;
4080 DELAY
4090     LDY #0
4100 DELAY2
4110     DEY
4120     BNE DELAY2
4130     DEX
4140     BNE DELAY
4150     RTS
4160 ;
4170 ;sub. to move alien shape down
4180 ;one line (up one byte in RAM)
4190 ;
4200 MOVEDOWN
4210     LDY ALIEN   ;get # bytes
4220 LOOPDOWN
4230     LDA (PLYRSTRT),Y ;get a byte
4240     INY         ;store one
4250     STA (PLYRSTRT),Y ;byte higher
4260     DEY         ;point to
4270     DEY         ;lower byte
4280     BPL LOOPDOWN ;go until 0
4290     INC YPOSP0  ;new Y position
4300     RTS
4310 ;
4320 ;sub. to move alien shape up
4330 ;one line (down one byte in RAM)
4340 ;
4350 MOVEUP
4360     LDA ALIEN   ;# bytes to move
4370     STA NBYTES  ;is 1 more than
4380     INC NBYTES  ;# player bytes
4390     LDY #1
4400 LOOPUP
4410     LDA (PLYRSTRT),Y ;get a byte
4420     DEY         ;store 1
4430     STA (PLYRSTRT),Y ;byte lower
4440     INY         ;point to
4450     INY         ;next one
4460     CPY NBYTES  ;done all?
4470     BNE LOOPUP  ;no, go on
4480     DEC YPOSP0  ;new Y position
4490     RTS
4580 ;
4590 ;data values needed
4600 ;
4610 SCREEN .BYTE "S"
4620 ;
4840 ;data for player shapes are
4850 ;stored in unused portion of
4860 ;PMG area
4870 ;
4880     *=  PMG
4890 ;
4900 ;normal alien
4910 ;
4920 ALIEN
4930     .BYTE 14,60,24,126,189,189
4940     .BYTE 189,189,60,60,36
4950     .BYTE 36,36,102,0
5180 ;
5190 ;car shape
5200 ;
5210 CAR
5220     .BYTE 15,126,195,219,219
5230     .BYTE 91,219,219,219,219
5240     .BYTE 91,219,219,195,126,0
```


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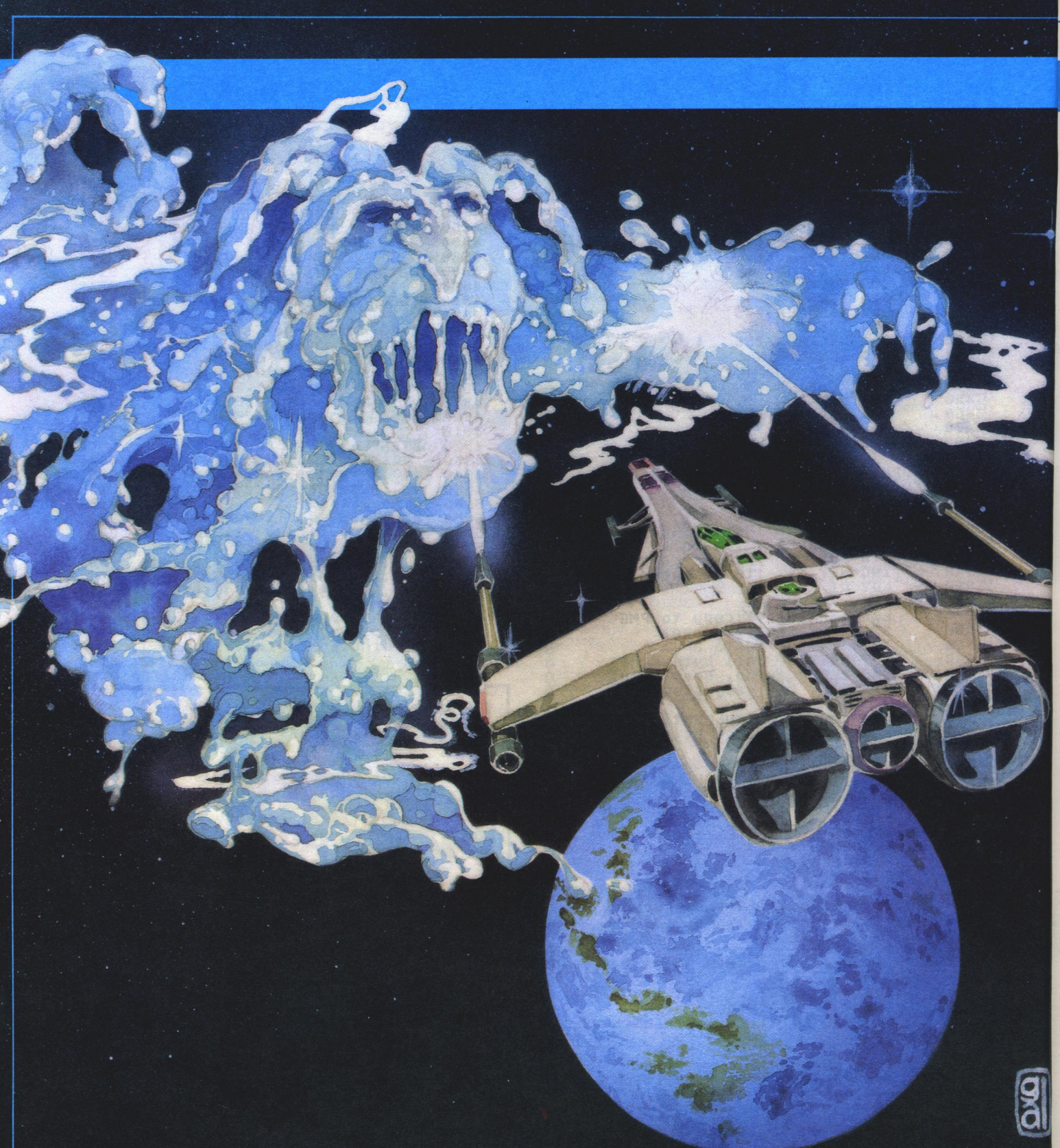

Cosmic Glob

by Rich B. Enns

In the year 2500, a giant energy cluster heads toward the Earth. Fighters are sent to intercept; only one returns. Is this the end? The surviving fighter brings little hope.

The media-christened **Cosmic Glob**, it seems, can only be destroyed by chunking it out and neutralizing its core. With the formation trapped in a weakening force field just short of the planet, you must destroy the horror before it destroys you—and the Earth.

Typing it in.

Listing 1 is the BASIC data used to create both cassette and disk versions of **Cosmic Glob**. Those readers who are interested in how the game works may obtain the assembly listing on either the magazine disk version or the **ANALOG Computing** Atari Users' Group on Delphi.

Disk users should refer to the **M/L Editor** article on page 42 for typing instructions.

If you have a cassette system, type in Listing 1, then add the lines shown in Listing 2. Type *RUN* and press RETURN. The program will begin checking the data statements, printing the line numbers as it goes. It will alert you to any problems. Fix any incorrect lines and rerun the program until all errors are eliminated.

When all your data lines are correct, the computer will beep twice and prompt you to *READY CASSETTE AND PRESS RETURN*. Now, insert a blank cassette in your recorder, press the RECORD and PLAY buttons simultaneously, and hit RETURN. The message *WRITING FILE* will appear, and the program will create a machine language boot tape version of **Cosmic Glob**, printing each data line number as it goes. When the *READY* prompt appears, the game is recorded and ready to play. CSAVE the BASIC program onto a separate tape before continuing.

To play the game, rewind the tape created with the BASIC program to the beginning. Turn your computer off and remove all cartridges. Press the PLAY button on your recorder and turn on your computer, while holding down the START key. If you have an XL or XE series computer, you must hold the START and OPTION keys when you turn on the power. The computer will beep once. Hit the RETURN key, and **Cosmic Glob** will load and run automatically.

Playing Cosmic Glob.

This is a one- or two-player game. When it boots up, the title screen will appear, with four options. Joystick 0 changes the options; pull it down to select one. Push the joystick right to change the selected option. Press the fire button to start **Cosmic Glob**.

You have several options for variations in the game: (1) number of players: select *1* or *2*; (2) number of ships: select from *3* to *7*, or * for an endless number of ships; (3) difficulty: choose a level from *1* to *30*; and (4) enable mines: select *Y* or *N* to enable mines or not.

Pressing the joystick 0 fire button starts the game. The **Glob** will appear immediately, along with a small defense ship. Your ship will be seen on the bottom. Player 1, on the left, uses joystick 0. Player 2, on the right, has joystick number 1.

Notice that your ship doesn't appear right away. It'll remain protected for about five seconds under a force field, then will appear automatically. Pull back on your stick to appear when you want. Do so only when it's safe.

Push forward on the joystick to move your ship. It'll head in one of eight directions. Push right to turn clockwise, left to turn counterclockwise. Pull back to flip. You may move and turn at the same time.

Contact with the **Glob**, a defense ship, or one of the mines is deadly. Contact with the force field is safe. If you collide with it head on, you'll bounce straight back. Hit on an angle, and you'll bounce off on an angle.

In two-player mode players may pass right through each other. When the two players overlap, a third color is produced. This is done by setting bit 5 of GPRIOR (623).

To fire missiles in your efforts to destroy the **Glob**, press the trigger. Missiles will have no effect on the force field, or on the defense ship. Shooting at mines will cause the **Glob** to regenerate.

In two-player mode, shooting at the other player causes

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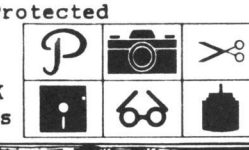

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Cosmic Glob *continued*

his ship to move in the direction of your missile for a short distance, during which time the other player has no control over the movement of his ship. He may still fire, however. Players can be nasty, forcing one another into one of many deadly objects.

The **Cosmic Glob** moves about your screen in an ominous fashion, annihilating any unsuspecting player in its path. It rebounds off the force field with some uncertainty.

When you shoot at the **Glob**, a small chunk of it will disappear. Keep firing at it until you reach the core, at the same time being wary of the **Glob**'s defense ship. It flies around the screen randomly. You can't destroy it, but it can turn you into dust on contact.

When you reach the **Glob**'s core, it will explode. The scores will be added up and displayed. For each **Glob** chunk you hit you'll be awarded 1 point. The player who destroys the **Glob** will receive 500 points.

Press either joystick's fire button to advance to the next level. Notice that scores don't change during play. Points are only awarded after the **Glob** is destroyed.

The game ends when all players have lost all of their ships. Getting hit by the **Glob** or a defense ship, or running into the mines are good ways to lose them. Press the fire button on either joystick to go to the title screen.

The game can be paused during play by pressing the SPACE BAR. Press any other key to resume play. The game can be restarted at any time by hitting START. If you're playing with an endless number of ships, pressing START is the only way to end the game.

One final note: the **Glob**'s defense ship moves slowly at the beginning of each level, but will speed up after a few minutes.

Enjoy **Cosmic Glob**—save yourself and the Earth.

Rich B. Enns has had his Atari system for about two years. He started programming in machine language about a year ago. His computer interests lie in graphics and game programming, and he enjoys two-player games especially.

The two-letter checksum code preceding the line numbers here is *not* a part of the BASIC program. For further information, see *BASIC Editor II* in issue 47.

The code is simply a double check for Listing 1; it's of more use with Listing 2.

Listing 1.
BASIC listing.

```
HI 1000 DATA 255,255,0,60,169,85,76,6,17,
   169,0,133,128,133,130,169,5559
PT 1010 DATA 7,133,129,169,60,133,131,160
   ,0,177,130,145,128,24,165,128,7104
YR 1020 DATA 105,1,133,128,165,129,105,0,
   133,129,24,165,130,105,1,133,4406
HA 1030 DATA 130,165,131,105,0,133,131,16
   5,129,201,33,208,220,76,6,17,5654
FN 1040 DATA 72,138,72,152,72,164,233,185
   ,234,0,141,10,212,141,20,208,8802
KX 1050 DATA 185,240,0,141,21,208,165,222
   ,141,22,208,165,223,141,23,208,866
TC 1060 DATA 165,224,141,25,208,230,233,1
   65,233,201,6,208,4,169,0,133,8782
JW 1070 DATA 233,104,168,104,170,104,64,7
   2,138,72,152,72,169,0,141,200,6939
BB 1080 DATA 2,169,15,205,120,2,208,5,205
   ,121,2,240,4,169,0,133,4896
UC 1090 DATA 77,173,4,6,201,8,208,6,169,2
   00,133,209,133,210,165,194,1846
XG 1100 DATA 201,1,240,3,76,24,14,165,175
   ,141,2,208,165,176,141,3,6252
PA 1110 DATA 208,160,0,185,188,29,145,142
   ,185,210,29,145,144,200,192,22,9371
OL 1120 DATA 208,241,169,0,145,142,145,14
   4,200,145,142,145,144,56,165,142,16
ZB 1130 DATA 233,2,133,146,56,165,144,233
   ,2,133,148,160,0,169,0,145,6074
QU 1140 DATA 146,145,148,200,145,146,145,
   148,165,232,201,1,240,11,230,192,2444
JL 1150 DATA 165,192,201,2,240,3,76,111,8
   ,169,0,133,192,230,193,165,9557
PM 1160 DATA 193,201,60,208,24,169,0,133,
   193,165,189,133,161,173,10,210,52
GL 1170 DATA 41,1,10,10,24,101,161,168,18
   5,84,15,133,189,164,189,24,6718
LF 1180 DATA 165,190,121,40,15,133,190,14
   1,6,208,24,165,191,121,40,15,4974
AH 1190 DATA 133,191,141,7,208,201,55,240
   ,46,201,197,240,42,24,165,136,9711
TE 1200 DATA 121,44,15,133,136,165,189,10
   ,10,10,170,160,0,177,136,41,4213
RI 1210 DATA 15,24,125,52,15,145,136,232,
   200,192,6,208,240,165,136,201,2577
IP 1220 DATA 150,240,4,201,232,208,14,164
   ,189,185,48,15,133,189,169,1,7669
PC 1230 DATA 133,203,76,23,8,230,184,165,
   184,201,12,208,34,169,0,133,7347
FA 1240 DATA 184,162,0,164,234,181,235,14
   9,234,232,224,5,208,247,132,239,6413
SW 1250 DATA 162,4,164,245,181,240,149,24
   1,202,224,255,208,247,132,240,169,8930
EO 1260 DATA 0,197,211,208,45,197,212,208
   ,41,169,1,197,171,240,4,197,903
QW 1270 DATA 172,208,23,169,3,141,15,210,
   169,129,141,8,210,169,130,141,9009
SX 1280 DATA 7,210,169,9,141,6,210,76,204
   ,8,169,0,141,7,210,141,6181
ZX 1290 DATA 6,210,162,0,181,209,201,0,24
   0,96,181,195,201,1,240,90,886
XG 1300 DATA 181,225,201,0,240,5,214,225,
   76,52,9,189,120,2,201,15,5476
RQ 1310 DATA 208,11,246,211,32,121,14,181
   ,211,201,255,208,61,169,0,149,307
EW 1320 DATA 211,149,158,149,207,32,121,1
   4,138,10,168,189,216,14,153,138,8050
TX 1330 DATA 0,133,150,185,139,0,133,151,
   134,161,162,0,160,0,140,7,4510
PD 1340 DATA 210,189,16,29,145,150,232,20
   0,192,10,208,245,166,161,189,214,4668
VV 1350 DATA 14,149,173,157,0,208,169,1,1
   49,195,232,236,2,6,240,3,7681
QS 1360 DATA 76,206,8,162,0,160,0,181,195
   ,201,1,240,3,76,214,9,6041
IX 1370 DATA 181,185,201,0,240,5,214,185,
   76,214,9,189,6,6,201,0,5100
OA 1380 DATA 208,31,189,120,2,201,15,208,
   7,169,0,149,171,76,214,9,5864
LK 1390 DATA 132,161,168,185,100,15,149,1
   58,169,1,149,171,164,161,76,214,157
FP 1400 DATA 9,246,169,181,169,201,5,208,
   32,169,0,149,169,189,120,2,7323
QM 1410 DATA 41,8,208,7,169,1,133,156,32,
   32,14,189,120,2,41,4,446
OQ 1420 DATA 208,7,169,255,133,156,32,32,
   14,181,187,201,0,240,5,214,8514
YL 1430 DATA 187,76,199,9,189,120,2,201,1
   3,208,18,181,158,168,185,16,7693
UH 1440 DATA 15,149,158,138,10,168,32,55,
   14,169,40,149,187,169,0,149,5726
PJ 1450 DATA 171,189,120,2,41,1,208,4,169
   ,1,149,171,232,200,200,224,1688
```

```
ZV 1460 DATA 2,240,3,76,65,9,162,0,189,13
   2,2,201,1,208,2,149,4562
IY 1470 DATA 207,181,171,201,1,240,3,76,1
   28,10,180,158,132,163,24,181,7812
CL 1480 DATA 173,121,190,14,149,173,157,0
   ,208,201,55,240,4,201,193,208,1859
DH 1490 DATA 25,180,158,185,218,14,149,15
   8,169,1,133,203,189,6,6,201,7847
UF 1500 DATA 0,208,4,169,3,149,185,76,244
   ,9,138,10,170,164,163,24,6675
JS 1510 DATA 181,138,121,198,14,149,138,1
   33,150,181,139,133,151,138,74,170,126
QU 1520 DATA 181,158,10,10,10,10,134,161,
   170,160,0,189,16,29,145,150,5010
TM 1530 DATA 232,200,192,10,208,245,166,1
   61,138,10,170,181,138,221,206,14,1324
IN 1540 DATA 240,5,221,210,14,208,28,138,
   74,170,180,158,185,226,14,149,316
DU 1550 DATA 158,169,1,133,203,189,6,6,20
   1,0,208,4,169,3,149,185,6399
IJ 1560 DATA 76,244,9,138,74,170,232,224,
   2,240,3,76,226,9,160,0,6336
XD 1570 DATA 162,1,185,12,208,41,12,208,2
   8,185,4,208,41,4,208,21,4058
NH 1580 DATA 132,161,230,161,173,10,208,3
   7,161,208,10,173,11,208,37,161,7946
HU 1590 DATA 208,3,76,21,11,169,0,153,195
   ,0,153,211,0,153,171,0,5086
RZ 1600 DATA 153,187,0,185,185,0,201,0,24
   0,25,181,230,201,0,240,19,8877
FQ 1610 DATA 248,24,181,218,105,2,149,218
   ,181,220,105,0,149,220,216,169,2590
FW 1620 DATA 0,149,230,169,150,153,225,0,
   165,223,141,200,2,56,185,209,1122
PD 1630 DATA 0,233,1,153,209,0,169,1,133,
   197,132,162,152,10,168,185,9106
GL 1640 DATA 138,0,133,150,185,139,0,133,
   151,160,0,169,0,145,150,200,8067
BB 1650 DATA 192,10,208,247,169,0,141,30,
   208,164,162,200,202,192,2,240,2424
YX 1660 DATA 3,76,140,10,162,0,181,195,20
   1,1,208,69,181,179,201,0,8721
DE 1670 DATA 208,63,173,5,6,201,0,208,6,1
   81,207,201,1,208,50,189,8695
IG 1680 DATA 132,2,201,0,208,43,149,207,1
   81,158,149,181,168,24,181,173,1439
MF 1690 DATA 121,234,14,149,177,138,10,17
   0,24,181,138,125,254,14,149,132,8949
KM 1700 DATA 24,181,132,121,242,14,149,13
   2,138,74,170,169,1,149,179,133,9151
DR 1710 DATA 200,232,224,2,208,176,162,0,
   134,162,162,0,181,179,201,1,8782
ZG 1720 DATA 240,3,76,197,12,180,181,132,
   163,24,181,177,121,190,14,149,9094
JK 1730 DATA 177,157,4,208,138,168,10,170
   ,185,177,0,201,56,240,59,201,229
QR 1740 DATA 199,240,55,164,163,24,181,13
   2,121,198,14,149,132,133,150,181,257
DN 1750 DATA 133,133,151,160,0,177,150,61
   ,2,15,145,150,200,177,150,61,7709
XL 1760 DATA 2,15,24,125,250,14,145,150,2
   00,177,150,61,2,15,145,150,6676
SE 1770 DATA 181,132,201,151,240,4,201,23
   4,208,13,32,98,14,138,74,170,7399
ZQ 1780 DATA 169,0,149,179,76,197,12,138,
   74,170,181,177,197,175,144,18,9802
PW 1790 DATA 24,165,175,105,31,213,177,14
   4,9,181,177,197,176,144,6,76,8725
RL 1800 DATA 19,12,76,197,12,56,181,177,2
   29,175,74,168,138,10,170,56,7959
GH 1810 DATA 181,132,233,127,133,150,76,3
   6,12,56,181,177,229,176,74,168,9869
SO 1820 DATA 138,10,170,24,181,132,105,1,
   133,150,165,145,133,151,134,163,9737
BA 1830 DATA 162,0,161,150,57,24,15,208,8
   ,166,163,138,74,170,76,197,8088
DS 1840 DATA 12,161,150,57,32,15,129,150,
   166,163,56,181,132,229,144,24,8583
BF 1850 DATA 105,1,168,177,142,153,188,29
   ,177,144,153,210,29,32,98,14,6100
FR 1860 DATA 138,74,170,169,0,149,179,248
   ,24,181,216,105,1,149,216,181,1360
QN 1870 DATA 218,105,0,149,218,181,220,10
   5,0,149,220,216,160,0,185,197,1959
RO 1880 DATA 29,57,92,15,240,8,185,219,29
   ,57,96,15,208,56,169,0,4744
PC 1890 DATA 133,194,133,195,133,196,133,
   171,133,172,133,179,133,180,141,7,734
IV 1900 DATA 210,141,5,210,141,3,210,141,
   1,210,248,24,181,218,105,5,8753
FE 1910 DATA 149,218,181,220,105,0,149,22
   0,216,162,0,32,98,14,162,2,5126
MX 1920 DATA 32,98,14,76,14,14,200,192,4,
   208,179,232,224,2,240,3,9041
SI 1930 DATA 76,118,11,162,0,160,1,189,0,
   208,41,5,240,30,134,164,6167
TS 1940 DATA 162,0,189,144,29,157,188,29,
   189,166,29,157,210,29,232,224,1644
IZ 1950 DATA 22,208,239,166,164,169,1,133
   ,197,76,15,13,189,8,208,61,6193
KB 1960 DATA 6,15,240,43,169,1,153,171,0,
   133,203,169,20,153,185,0,6946
EY 1970 DATA 181,181,153,158,0,169,0,149,
   179,169,1,149,230,132,161,138,371
VX 1980 DATA 10,170,32,98,14,169,0,141,30
   ,208,138,74,170,164,161,136,8883
RX 1990 DATA 232,224,2,208,162,166,162,23
   2,224,2,240,3,76,114,11,165,8405
RH 2000 DATA 197,201,1,240,9,165,198,201,
   1,240,30,76,120,13,169,0,5519
KU 2010 DATA 133,197,169,1,133,198,169,3,
   141,15,210,169,129,141,8,210,8996
WQ 2020 DATA 169,47,141,1,210,169,4,133,1
   99,230,199,165,199,141,0,210,2047
YB 2030 DATA 201,52,208,10,169,0,141,0,21
   0,141,1,210,133,198,165,200,838
LL 2040 DATA 201,1,240,9,165,201,201,1,24
   0,30,76,185,13,169,0,133,6624
BU 2050 DATA 200,169,1,133,201,169,3,141,
   15,210,169,129,141,8,210,169,9732
AN 2060 DATA 135,141,3,210,169,255,133,20
   2,230,202,165,202,133,202,141,2,3281
VY 2070 DATA 210,201,15,208,10,169,0,141,
   3,210,141,2,210,133,201,165,9700
MZ 2080 DATA 203,201,1,240,9,165,204,201,
   1,240,35,76,14,14,169,0,4338
ZE 2090 DATA 133,203,169,1,133,204,169,3,
   141,15,210,169,129,141,8,210,9124
JF 2100 DATA 173,10,210,41,15,24,105,10,1
   33,205,169,17,133,206,198,206,310
MJ 2110 DATA 198,206,24,165,206,105,160,1
   41,5,210,165,206,10,10,24,101,6038
VX 2120 DATA 205,141,4,210,165,206,201,25
   5,208,10,169,0,141,5,210,141,107
RF 2130 DATA 4,210,133,204,162,0,32,116,2
   4,162,1,32,116,24,104,168,4054
GT 2140 DATA 104,170,104,76,98,228,24,181
   ,158,101,156,149,158,201,8,208,926
TO 2150 DATA 4,169,0,149,158,201,255,208,
   4,169,7,149,158,181,158,10,9242
WD 2160 DATA 10,10,10,133,160,134,161,185
   ,138,0,133,150,185,139,0,133,7947
DZ 2170 DATA 151,132,162,165,160,170,160,
   0,189,16,29,145,150,232,200,192,1861
CG 2180 DATA 10,208,245,166,161,164,162,9
   6,181,132,133,150,181,133,133,151,2534
KV 2190 DATA 160,0,177,150,61,2,15,145,15
   0,200,192,3,208,244,96,138,329
YK 2200 DATA 10,168,185,152,0,133,150,185
   ,153,0,133,151,169,134,141,7,7989
UQ 2210 DATA 210,181,211,41,170,133,162,1
   81,211,73,255,74,74,141,6,210,517
RU 2220 DATA 134,161,162,0,160,0,165,162,
   145,150,200,192,3,208,247,24,762
PS 2230 DATA 165,150,105,80,133,150,165,1
   51,105,0,133,151,232,224,6,208,1048
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YT 2240 DATA 227,166,161,96,0,1,1,1,0,255
   ,255,255,255,255,0,1,9003
RI 2250 DATA 1,1,0,255,22,0,150,0,100,0,2
   28,0,58,190,97,225,6310
CG 2260 DATA 4,7,6,5,0,3,2,1,4,3,6,1,0,7,
   2,5,2708
GS 2270 DATA 4,2,2,2,3,5,5,5,5,5,4,2,2,2,
   3,5,2754
MI 2280 DATA 2,0,8,0,128,0,0,0,252,0,243,
   0,2,1,4,5,8067
PU 2290 DATA 6,7,0,1,2,3,4,5,6,7,0,1,2,3,
   128,64,5558
DP 2300 DATA 32,16,8,4,2,1,127,191,223,23
   9,247,251,253,254,0,1,1824
NJ 2310 DATA 0,255,255,0,1,0,2,3,0,1,0,14
   4,144,240,96,0,2038
GA 2320 DATA 0,0,0,112,192,192,112,0,0,0,
   0,96,240,144,144,0,4112
RR 2330 DATA 0,0,0,224,48,48,224,0,0,0,3,
   0,1,2,1,2,5443
MF 2340 DATA 3,0,1,2,2,1,128,64,64,128,0,
   0,0,0,0,3,5682
VX 2350 DATA 1,2,0,5,7,6,0,4,0,0,0,0,0,0,
   0,99,4062
WR 2360 DATA 111,115,109,105,99,0,103,108
   ,111,98,0,0,0,0,0,0,7507
WU 2370 DATA 0,0,0,0,0,0,0,187,163,189,0,16
   2,185,0,0,0,0,686
OB 2380 DATA 0,0,0,0,0,0,0,0,0,50,41,35,40,0,
   34,14,0,37,5169
GP 2390 DATA 46,46,51,0,0,0,0,0,0,0,195,0,2
   39,230,0,240,236,7865
HH 2400 DATA 225,249,229,242,243,154,17,0
   ,92,0,0,0,0,0,0,0,7864
IM 2410 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,2410
OH 2420 DATA 0,0,0,195,0,239,230,0,243,23
   2,233,240,243,154,21,0,1824
ME 2430 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,2430
YG 2440 DATA 0,0,0,0,0,0,0,0,0,0,0,0,228,23
   3,230,230,233,8603
CM 2450 DATA 227,245,236,244,249,154,16,1
   7,0,0,0,0,0,0,0,0,7268
RS 2460 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,2460
PW 2470 DATA 0,229,238,225,226,236,229,12
   8,237,233,238,229,243,154,57,0,5714
VK 2480 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,2480
AP 2490 DATA 0,0,0,0,0,0,0,0,0,0,0,242,229,
   240,229,225,244,1505
LY 2500 DATA 128,230,233,242,229,154,57,0
   ,0,0,0,0,0,0,0,0,7223
KG 2510 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,2510
KN 2520 DATA 0,227,239,238,244,242,239,23
   6,128,244,249,240,229,154,40,40,6460
NY 2530 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,2530
PN 2540 DATA 0,0,71,0,0,0,0,0,0,0,0,169,1
   68,141,1,210,2314
JZ 2550 DATA 134,167,162,4,134,168,142,0,
   210,162,0,232,224,100,208,251,3934
MF 2560 DATA 166,168,232,224,200,208,237,
   169,0,141,0,210,141,1,210,166,1496
HX 2570 DATA 167,96,160,2,169,0,145,130,2
   4,165,130,105,40,133,130,165,7845
UU 2580 DATA 131,105,0,133,131,169,92,145
   ,130,160,0,32,165,16,96,160,6449
YK 2590 DATA 2,169,0,145,130,56,165,130,2
   33,40,133,130,165,131,233,0,9685
TX 2600 DATA 133,131,169,92,145,130,160,0
   ,32,165,16,96,169,1,141,2,4119
HJ 2610 DATA 6,141,3,6,169,5,141,4,6,169,
   0,141,1,6,169,1,909
QQ 2620 DATA 141,0,6,141,5,6,141,6,6,141,
   7,6,56,165,106,233,4408
US 2630 DATA 26,133,131,141,8,6,169,0,133
   ,130,169,40,133,128,169,30,6510
BB 2640 DATA 133,129,160,0,177,128,145,13
   0,24,165,128,105,1,133,128,165,8188
JE 2650 DATA 129,105,0,133,129,24,165,130
   ,105,1,133,130,165,131,105,0,6037
LY 2660 DATA 133,131,56,233,2,205,8,6,208
   ,218,169,0,205,132,2,240,9793
CB 2670 DATA 249,205,133,2,240,244,32,81,
   28,169,0,141,29,208,162,0,6625
VM 2680 DATA 157,0,210,232,224,9,208,248,
   32,100,25,173,8,6,141,244,8855
EB 2690 DATA 2,169,170,141,196,2,169,12,1
   41,197,2,169,180,141,198,2,8980
IJ 2700 DATA 162,0,160,20,189,117,15,145,
   88,232,200,224,60,208,245,24,2085
KC 2710 DATA 165,88,105,120,133,130,133,1
   28,165,89,105,0,133,131,133,129,8398
FM 2720 DATA 160,0,185,177,15,145,130,200
   ,192,240,208,246,169,3,141,15,1560
PC 2730 DATA 210,169,0,141,8,210,32,165,1
   6,32,165,16,165,128,133,130,7169
BO 2740 DATA 165,129,133,131,24,165,130,1
   05,15,133,130,165,131,105,0,133,7122
X5 2750 DATA 131,160,2,169,92,145,130,160
   ,0,32,165,16,173,120,2,201,6905
BV 2760 DATA 7,208,31,238,2,6,173,2,6,201
   ,3,208,5,169,1,141,4796
FH 2770 DATA 2,6,24,173,2,6,105,16,145,13
   0,162,15,157,177,15,32,4280
PQ 2780 DATA 165,16,173,132,2,201,0,208,3
   ,76,129,20,173,120,2,201,6525
HD 2790 DATA 14,208,31,160,2,169,0,145,13
   0,24,165,128,105,215,133,130,9348
NH 2800 DATA 165,129,105,0,133,131,169,92
   ,145,130,160,0,32,165,16,76,5455
BU 2810 DATA 241,19,201,13,208,166,32,204
   ,16,173,120,2,201,7,208,18,6973
RQ 2820 DATA 238,4,6,173,4,6,201,9,208,27
   ,169,3,141,4,6,76,2543
ZQ 2830 DATA 127,18,201,11,208,45,206,4,6
   ,173,4,6,201,2,208,5,4165
TN 2840 DATA 169,8,141,4,6,173,4,6,201,8,
   208,7,169,10,145,130,5461
TM 2850 DATA 76,149,18,173,4,6,24,105,16,
   145,130,162,55,157,177,15,5810
ZQ 2860 DATA 32,165,16,173,132,2,201,0,20
   8,3,76,129,20,173,120,2,4841
OB 2870 DATA 201,14,208,6,32,233,16,76,24
   6,17,201,13,208,155,32,204,9394
PR 2880 DATA 16,173,120,2,201,7,208,34,23
   8,1,6,248,24,173,0,6,4409
BZ 2890 DATA 105,1,141,0,6,216,173,1,6,20
   1,30,208,48,169,0,141,6101
LD 2900 DATA 1,6,169,1,141,0,6,76,7,19,20
   1,11,208,70,206,1,4165
MZ 2910 DATA 6,248,56,173,0,6,233,1,141,0
   ,6,216,173,1,6,201,5443
MB 2920 DATA 255,208,10,169,29,141,1,6,16
   9,48,141,0,6,160,0,173,3981
KI 2930 DATA 0,6,74,74,74,74,24,105,16,14
   5,130,162,95,157,177,15,6578
YL 2940 DATA 160,1,173,0,6,41,15,24,105,1
   6,145,130,162,96,157,177,7091
JJ 2950 DATA 15,32,165,16,173,132,2,201,0
   ,208,3,76,129,20,173,120,6364
YY 2960 DATA 2,201,14,208,6,32,233,16,76,
   83,18,201,13,240,3,76,5133
BT 2970 DATA 187,18,32,204,16,173,120,2,2
   01,7,208,44,238,3,6,173,6768
HH 2980 DATA 3,6,201,2,208,5,169,0,141,3,
   6,162,135,173,3,6,3486
BO 2990 DATA 201,1,208,10,169,57,145,130,
   157,177,15,76,127,19,169,46,6547
VI 3000 DATA 145,130,157,177,15,32,165,16
   ,173,132,2,201,0,208,3,76,5618
QX 3010 DATA 129,20,173,120,2,201,14,208,
   6,32,233,16,76,187,18,201,7377
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YT 3020 DATA 13,208,178,32,204,16,173,120
,2,201,7,208,44,238,5,6,6074
UX 3030 DATA 173,5,6,201,2,208,5,169,0,14
1,5,6,162,175,173,5,5448
RR 3040 DATA 6,201,0,208,10,169,46,145,13
0,157,177,15,76,208,19,169,8582
BP 3050 DATA 57,145,130,157,177,15,32,165
,16,173,132,2,201,0,208,3,6065
QA 3060 DATA 76,129,20,173,120,2,201,14,2
08,6,32,233,16,76,79,19,4118
UR 3070 DATA 201,13,208,178,32,204,16,24,
165,130,105,20,133,165,165,131,9111
GQ 3080 DATA 105,0,133,166,162,215,173,12
0,2,201,11,240,98,201,7,208,1069
NM 3090 DATA 42,24,185,6,6,105,1,153,6,6,
201,2,208,5,169,0,3308
OJ 3100 DATA 153,6,6,201,0,208,10,169,37,
145,130,157,177,15,76,50,6305
JL 3110 DATA 20,169,40,145,130,157,177,15
,32,165,16,173,132,2,201,0,6068
YX 3120 DATA 240,69,173,120,2,201,14,208,
17,160,0,169,71,145,165,200,9884
UC 3130 DATA 169,0,145,165,32,233,16,76,1
60,19,201,13,208,168,160,0,8125
UY 3140 DATA 169,71,145,165,200,169,0,145
,165,200,145,130,76,214,17,169,1303
HG 3150 DATA 0,145,165,232,200,192,2,208,
4,160,0,162,215,169,71,145,819
ID 3160 DATA 165,32,165,16,76,0,20,32,181
,25,173,8,6,141,244,2,4346
VG 3170 DATA 32,193,24,32,96,28,173,1,6,1
33,227,10,10,10,10,133,2204
XA 3180 DATA 165,32,209,28,173,4,6,133,20
9,133,210,162,0,32,116,24,6180
XB 3190 DATA 162,1,32,116,24,24,169,166,1
01,165,141,196,2,24,169,218,9536
XE 3200 DATA 101,165,141,197,2,24,169,104
,101,165,141,198,2,24,169,10,6554
OA 3210 DATA 101,165,141,199,2,24,169,98,
101,165,133,222,24,169,106,101,9551
GZ 3220 DATA 165,133,223,24,169,190,101,1
65,133,224,24,169,166,101,165,141,2460
QI 3230 DATA 192,2,24,169,218,101,165,141
,193,2,173,3,6,201,1,208,8084
EU 3240 DATA 3,32,144,27,32,181,26,165,22
7,170,189,40,25,141,17,22,5803
UA 3250 DATA 189,70,25,141,13,22,165,232,
201,1,240,10,165,19,201,8,7559
QY 3260 DATA 208,4,169,1,133,232,173,31,2
08,201,6,208,10,169,0,133,8571
HO 3270 DATA 194,32,167,28,76,100,17,162,
0,181,209,201,0,208,9,232,9816
AP 3280 DATA 236,2,6,208,244,76,23,22,173
,252,2,201,33,208,35,169,9464
BZ 3290 DATA 0,133,194,141,1,210,141,3,21
0,141,5,210,141,7,210,166,590
JJ 3300 DATA 20,164,19,173,252,2,201,33,2
40,249,169,1,133,194,132,19,590
AK 3310 DATA 134,20,162,0,164,183,24,165,
175,121,232,24,133,175,24,165,180
NG 3320 DATA 176,121,232,24,133,176,32,25
1,21,165,175,201,50,240,4,201,1945
JT 3330 DATA 174,208,28,173,10,210,41,1,1
0,10,10,133,165,165,183,24,5781
GQ 3340 DATA 101,165,168,185,8,25,133,183
,169,1,133,203,76,16,21,232,8269
UU 3350 DATA 164,183,138,217,248,24,208,1
88,162,0,164,183,24,165,142,121,1652
RW 3360 DATA 240,24,133,142,24,165,144,12
1,240,24,133,144,32,251,21,165,177
ND 3370 DATA 142,201,18,240,4,201,92,208,
28,173,10,210,41,1,10,10,3931
PU 3380 DATA 10,133,165,165,183,24,101,16
5,168,185,24,25,133,183,169,1,8665
NB 3390 DATA 133,203,76,16,21,232,164,183
,138,217,0,25,208,188,76,16,8774
NK 3400 DATA 21,134,166,162,0,232,160,0,2
00,165,194,201,0,208,3,76,9516
QU 3410 DATA 77,23,192,0,208,242,224,0,20
8,235,166,166,96,165,198,201,5953
AA 3420 DATA 0,208,250,169,0,133,194,162,
0,169,0,157,0,210,232,224,2292
WT 3430 DATA 9,208,246,32,106,26,32,167,2
8,169,96,141,2,208,169,128,9178
AO 3440 DATA 141,3,208,169,52,133,142,169
,180,133,144,169,3,141,10,208,344
AQ 3450 DATA 141,11,208,162,0,160,0,189,1
46,29,145,142,189,168,29,145,9824
ZU 3460 DATA 144,200,189,146,29,145,142,1
89,168,29,145,144,232,200,192,36,3073
TC 3470 DATA 208,229,24,165,88,105,80,133
,130,165,89,105,3,133,131,162,9079
NP 3480 DATA 0,160,0,189,213,22,145,130,2
32,200,192,24,208,245,24,165,3430
YU 3490 DATA 130,105,40,133,130,165,131,1
05,0,133,131,224,120,208,226,169,3904
JR 3500 DATA 3,141,15,210,169,5,141,8,210
,169,166,141,1,210,169,162,1774
FM 3510 DATA 141,5,210,169,216,141,0,210,
169,217,141,4,210,169,0,205,2239
GF 3520 DATA 132,2,240,5,205,133,2,208,24
4,141,1,210,141,5,210,141,1343
FZ 3530 DATA 0,210,141,4,210,32,167,28,76
,100,17,170,170,170,0,170,8245
MW 3540 DATA 0,170,0,170,170,170,0,0,170,
170,170,0,170,170,170,0,8670
GT 3550 DATA 170,170,160,0,170,0,0,170,0,
170,0,170,0,0,0,0,490
PY 3560 DATA 170,0,0,0,170,0,170,0,170,0,
170,0,170,0,0,170,4100
SD 3570 DATA 170,170,0,170,170,0,0,0,170,
170,0,0,170,0,170,0,3600
AB 3580 DATA 170,0,170,0,170,0,0,170,0,17
0,0,170,0,0,0,0,210
XC 3590 DATA 170,0,0,0,170,0,170,0,170,0,
170,0,170,0,0,170,4130
WB 3600 DATA 0,170,0,170,170,170,0,0,170,
170,170,0,170,0,170,0,6350
DH 3610 DATA 170,170,160,32,167,28,169,3,
141,15,210,169,4,141,8,210,8201
AN 3620 DATA 169,15,141,1,210,169,9,141,3
,210,169,3,141,5,210,169,9280
JI 3630 DATA 5,141,7,210,169,10,133,199,2
4,165,142,105,10,133,180,105,9266
X5 3640 DATA 2,133,179,105,127,133,182,10
5,2,133,181,162,0,169,255,141,2142
EX 3650 DATA 207,23,134,165,165,179,133,1
42,165,180,133,146,165,181,133,144,440
9
XA 3660 DATA 165,182,133,148,162,0,160,0,
24,165,199,141,0,210,105,8,7500
BE 3670 DATA 141,2,210,105,8,141,4,210,10
5,8,141,6,210,230,199,198,2210
CK 3680 DATA 142,230,146,198,144,230,148,
169,0,32,93,24,198,142,230,146,1979
XV 3690 DATA 198,144,230,148,169,0,32,93,
24,134,166,162,20,202,160,160,645
ZB 3700 DATA 136,192,0,208,251,224,0,208,
244,166,166,232,224,24,208,184,7093
XA 3710 DATA 169,0,141,207,23,166,165,232
,224,2,208,150,162,0,169,0,17
MX 3720 DATA 157,0,210,232,224,9,208,246,
133,179,133,180,169,0,205,132,4027
BN 3730 DATA 2,240,22,205,133,2,240,17,17
3,31,208,201,6,208,237,169,3407
KH 3740 DATA 0,133,194,32,167,28,76,100,1
7,32,167,28,165,227,201,29,8499
AX 3750 DATA 240,2,230,227,162,0,24,189,1
92,2,105,16,157,192,2,232,9648
ET 3760 DATA 224,8,208,242,162,0,24,181,2
34,105,16,149,234,232,224,12,2980
IW 3770 DATA 208,244,162,0,24,181,222,105
,16,149,222,232,224,3,208,244,5390
CH 3780 DATA 76,254,20,145,142,145,146,14
5,144,145,148,230,175,198,176,165,6227
OI 3790 DATA 175,141,2,208,165,176,141,3,
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   208,96,138,201,1,208,7,173,537
IE 3800 DATA 2,6,201,2,208,64,188,228,24,
   24,181,209,105,16,201,24,8932
BS 3810 DATA 144,2,169,10,24,125,230,24,1
   45,88,181,216,133,213,181,218,4859
BP 3820 DATA 133,214,181,220,133,215,188,
   206,24,162,2,181,213,74,74,74,852
LU 3830 DATA 74,24,105,208,145,88,200,181
   ,213,41,15,24,105,208,145,88,9840
RZ 3840 DATA 200,202,224,255,208,229,96,1
   60,0,185,208,24,145,88,200,192,4117
LA 3850 DATA 20,208,246,96,3,13,0,16,30,2
   08,208,208,208,208,208,0,1499
XI 3860 DATA 0,80,94,208,208,208,208,208,
   208,0,1,11,0,64,1,1,3484
TA 3870 DATA 1,1,255,255,255,255,255,255,
   1,1,1,1,255,255,1,2,9262
OM 3880 DATA 2,1,1,2,2,1,2,1,1,2,2,1,1,2,
   7,6,4238
XR 3890 DATA 5,4,3,2,1,0,6,7,4,5,2,3,0,1,
   3,2,4258
QN 3900 DATA 1,0,7,6,5,4,2,3,0,1,6,7,4,5,
   30,29,5229
CD 3910 DATA 27,25,24,22,21,20,19,18,17,1
   4,13,12,10,10,10,10,5809
HW 3920 DATA 8,8,8,8,8,8,8,8,8,8,8,8,32,3
   0,28,27,6232
OP 3930 DATA 24,23,22,21,20,19,18,20,20,2
   0,23,22,21,20,24,23,6828
TN 3940 DATA 22,21,20,19,18,17,16,15,14,1
   3,169,17,32,36,28,173,991
CV 3950 DATA 48,2,133,128,173,49,2,133,12
   9,160,0,185,150,25,145,128,8654
AH 3960 DATA 200,192,28,208,246,160,4,165
   ,88,145,128,200,165,89,145,128,2662
NY 3970 DATA 160,25,165,128,145,128,200,1
   65,129,145,128,96,112,112,112,71,411
EJ 3980 DATA 200,200,7,7,7,7,6,6,6,6,6,6,
   6,6,6,6,5396
XN 3990 DATA 6,6,6,6,65,100,100,0,0,0,0,5
   6,165,106,233,16,3727
IG 4000 DATA 133,89,233,2,141,49,2,133,12
   9,169,0,133,88,141,48,2,5412
QP 4010 DATA 133,128,160,0,169,112,145,12
   8,200,145,128,200,145,128,160,3,1618
TQ 4020 DATA 169,198,145,128,200,165,88,1
   45,128,200,165,89,145,128,160,6,1506
WQ 4030 DATA 169,205,145,128,165,88,133,1
   30,165,89,133,131,165,130,24,105,295
QX 4040 DATA 40,133,130,165,131,105,0,133
   ,131,160,7,165,130,145,128,200,1421
CT 4050 DATA 165,131,145,128,160,9,169,14
   1,145,128,200,192,97,208,247,169,6260
BR 4060 DATA 13,145,128,200,145,128,200,1
   45,128,200,169,65,145,128,200,165,4708
AV 4070 DATA 128,145,128,200,165,129,145,
   128,24,165,88,105,40,133,130,165,376
IL 4080 DATA 89,105,0,133,131,162,0,134,1
   65,162,0,160,0,189,177,26,8352
XF 4090 DATA 145,130,200,192,40,208,246,2
   4,165,130,105,40,133,130,165,131,1765
MJ 4100 DATA 105,0,133,131,232,224,4,208,
   226,166,165,232,224,23,208,215,7411
QT 4110 DATA 24,165,88,105,202,133,130,16
```


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   5,89,105,0,133,131,162,0,160,9164
EE 4120 DATA 0,169,0,145,130,200,192,36,2
   08,247,24,165,130,105,40,133,994
MO 4130 DATA 130,165,131,105,0,133,131,23
   2,224,84,208,227,24,165,88,105,2464
MV 4140 DATA 10,133,152,165,89,105,12,133
   ,153,24,165,88,105,43,133,154,8669
UU 4150 DATA 165,89,105,12,133,155,96,150
   ,165,105,90,173,10,210,41,7,7721
QG 4160 DATA 133,183,169,0,133,175,141,2,
   208,169,240,133,176,141,3,208,3317
TV 4170 DATA 169,30,133,142,169,158,133,1
   44,169,1,141,10,208,141,11,208,615
KX 4180 DATA 162,0,189,144,29,157,188,29,
   232,224,44,208,245,160,0,185,3813
QL 4190 DATA 144,29,145,142,185,166,29,14
   5,144,200,192,22,208,241,169,3,3012
PY 4200 DATA 141,15,210,169,5,141,8,210,1
   69,172,141,1,210,169,164,141,2900
UT 4210 DATA 5,210,169,50,133,199,169,54,
   133,205,230,175,198,176,165,175,7006
RY 4220 DATA 141,2,208,165,176,141,3,208,
   201,128,240,31,162,0,232,160,3307
TM 4230 DATA 0,200,192,255,208,251,224,3,
   208,244,230,199,230,205,165,199,1113
YZ 4240 DATA 141,0,210,165,205,141,4,210,
   76,20,27,169,0,141,1,210,7808
FI 4250 DATA 141,5,210,141,0,210,141,4,21
   0,173,10,210,41,3,133,189,9718
TE 4260 DATA 169,0,133,193,133,192,133,22
   5,133,226,133,211,133,212,133,187,7284
MJ 4270 DATA 133,188,141,252,2,133,20,133
   ,19,133,232,169,128,133,190,169,3383
CP 4280 DATA 126,133,191,169,166,133,136,
   169,1,133,194,169,3,141,15,210,952
UC 4290 DATA 169,129,141,8,210,96,162,0,2
   4,165,88,125,32,28,133,130,7149
KW 4300 DATA 232,165,89,125,32,28,133,131
   ,232,134,165,162,0,160,0,189,387
AG 4310 DATA 232,29,145,130,232,200,192,4
   ,208,245,24,165,130,105,40,133,1745
MP 4320 DATA 130,165,131,105,0,133,131,22
   4,56,208,226,169,3,141,15,210,1796
KU 4330 DATA 169,5,141,8,210,169,156,141,
   0,210,169,157,141,4,210,162,2722
XC 4340 DATA 0,134,167,24,169,160,101,167
   ,141,1,210,74,141,5,210,169,1287
AU 4350 DATA 253,133,20,169,0,133,19,165,
   19,201,1,208,250,232,224,16,2658
PR 4360 DATA 208,223,169,0,141,1,210,141,
   5,210,141,0,210,141,4,210,650
JF 4370 DATA 133,19,169,230,133,20,165,19
   ,201,1,208,250,166,165,224,4,3059
JJ 4380 DATA 240,3,76,146,27,96,75,6,89,6
   ,72,162,96,169,12,157,6625
CX 4390 DATA 66,3,32,86,228,162,96,169,3,
   157,66,3,169,93,157,68,8339
ER 4400 DATA 3,169,28,157,69,3,104,157,75
   ,3,41,240,73,16,9,12,3336
VU 4410 DATA 157,74,3,32,86,228,96,162,0,
   169,0,149,128,232,224,128,2416
WA 4420 DATA 208,247,96,83,58,155,56,165,
   106,233,24,141,7,212,133,157,1480
YT 4430 DATA 169,46,141,47,2,169,56,141,1
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   11,2,169,0,141,8,208,141,8045
HM 4440 DATA 9,208,141,12,208,169,1,141,1
   0,208,141,11,208,24,165,157,405
FV 4450 DATA 105,1,133,133,133,135,133,13
   7,105,1,133,139,133,141,105,1,8370
JV 4460 DATA 133,143,133,145,133,147,133,
   149,169,3,141,29,208,160,0,169,626
IH 4470 DATA 0,133,130,165,157,133,131,16
   9,0,145,130,24,165,130,105,1,8362
AP 4480 DATA 133,130,165,131,105,0,133,13
   1,56,165,131,229,157,201,4,208,2982
LF 4490 DATA 230,169,0,141,30,208,96,169,
   58,141,0,2,169,7,141,1,5426
HW 4500 DATA 2,169,192,141,14,212,162,0,1
   60,4,152,24,101,165,149,234,1498
VF 4510 DATA 200,200,232,224,6,208,243,16
   2,0,160,14,152,24,101,165,149,1140
OL 4520 DATA 240,136,136,232,224,6,208,24
   3,169,0,133,233,160,113,162,7,2908
QI 4530 DATA 169,7,32,92,228,96,0,8,8,28,
   28,62,62,107,65,0,1640
GS 4540 DATA 0,0,0,0,0,0,0,3,15,62,254,12
   4,28,24,8,0,421
ME 4550 DATA 0,0,0,0,0,0,0,0,192,112,60,1
   27,60,112,192,0,4810
WN 4560 DATA 0,0,0,0,0,0,0,8,24,28,124,25
   4,62,15,3,0,593
JC 4570 DATA 0,0,0,0,0,0,0,130,214,124,12
   4,56,56,16,16,0,2004
JT 4580 DATA 0,0,0,0,0,0,0,16,24,56,62,12
   7,124,240,192,0,5542
OE 4590 DATA 0,0,0,0,0,0,0,3,14,60,254,60
   ,14,3,0,0,9078
RC 4600 DATA 0,0,0,0,0,0,0,192,240,124,12
   7,62,56,24,16,0,2981
DN 4610 DATA 0,0,0,0,0,0,0,0,7,15,31,63,1
   27,255,255,255,9046
RH 4620 DATA 254,254,255,255,255,127,63,3
   1,15,7,0,0,0,0,224,240,7298
MZ 4630 DATA 248,252,254,255,255,255,127,
   127,255,255,255,254,252,248,240,224,65
   04
UY 4640 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,4640
WU 4650 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,4650
XN 4660 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,252,8692
YW 4670 DATA 63,0,3,255,255,192,15,223,24
   7,240,63,87,213,252,61,95,5170
CP 4680 DATA 245,124,63,125,125,252,15,24
   5,95,240,15,245,95,240,63,125,3964
RD 4690 DATA 125,252,61,95,245,124,63,87,
   213,252,15,223,247,240,3,255,6962
UM 4700 DATA 255,192,0,252,63,0,0,0,0,0,0
   ,0,0,0,0,0,6662
ZF 4710 DATA 0,0,0,0,0,0,56,56,56,56,56,0
   ,56,0,102,102,1120
NS 4720 DATA 102,0,0,0,0,0,108,254,108,10
   8,108,254,108,0,56,254,206
YH 4730 DATA 224,254,6,254,56,0,230,238,2
   8,56,112,238,206,0,124,108,1456
TF 4740 DATA 104,248,222,204,246,0,56,56,
   56,0,0,0,0,0,28,56,712
IJ 4750 DATA 48,48,48,56,28,0,56,28,12,12
   ,12,28,56,0,108,56,9958
EM 4760 DATA 254,124,254,56,108,0,24,24,2
   4,255,24,24,24,0,0,0,778
UF 4770 DATA 0,0,56,56,120,0,0,0,0,254,0,
   0,0,0,0,0,8302
NH 4780 DATA 0,0,0,56,56,0,4,14,28,56,112
   ,224,64,0,254,230,8478
RF 4790 DATA 230,230,246,246,254,0,248,24
   ,24,24,24,248,254,0,254,198,4376
FJ 4800 DATA 6,254,224,224,254,0,254,14,1
   4,126,14,14,254,0,230,230,2182
AI 4810 DATA 230,254,6,6,6,0,254,224,224,
   254,6,198,254,0,254,230,6980
VW 4820 DATA 224,254,230,230,254,0,254,20
   6,14,14,14,14,14,0,254,230,118
AF 4830 DATA 230,254,230,230,254,0,254,20
   6,206,254,14,206,254,0,0,56,3092
MB 4840 DATA 56,0,56,56,0,0,0,56,56,0,56,
   56,120,0,14,28,9746
IA 4850 DATA 56,252,56,28,14,0,0,0,254,0,
   0,254,0,0,224,112,6246
HV 4860 DATA 56,126,56,112,224,0,254,198,
   6,62,56,0,56,0,254,230,9774
NY 4870 DATA 230,238,238,224,254,0,254,23
   0,230,254,230,230,230,0,254,230,2454
NJ 4880 DATA 230,252,230,230,254,0,254,23
   0,224,224,224,230,254,0,252,230,2354
XB 4890 DATA 230,230,230,230,252,0,254,22
   4,224,252,224,224,254,0,254,224,2404
RO 4900 DATA 224,252,224,224,224,0,254,22
   4,224,238,230,230,254,0,230,230,2004
NU 4910 DATA 230,254,230,230,230,0,254,56
   ,56,56,56,56,254,0,0,14,6512
MO 4920 DATA 14,14,14,206,254,0,230,230,2
   30,252,230,230,230,0,224,224,362
SJ 4930 DATA 224,224,224,224,254,0,254,21
   4,214,198,198,198,198,0,254,230,454
MQ 4940 DATA 230,230,230,230,230,0,254,23
   0,230,230,230,230,254,0,254,230,2460
RO 4950 DATA 230,254,224,224,224,0,254,23
   0,230,230,230,238,252,0,254,230,2516
HG 4960 DATA 230,252,230,230,230,0,254,23
   0,224,254,6,198,254,0,254,56,7078
KG 4970 DATA 56,56,56,56,56,0,230,230,230
   ,230,230,230,254,0,230,230,9352
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QZ 4980 DATA 230,230,230,124,56,0,198,198
   ,198,198,214,214,254,0,198,198,8230
EV 4990 DATA 124,124,124,198,198,0,230,23
   0,230,254,24,24,24,0,254,14,474
WH 5000 DATA 28,56,112,224,254,0,124,112,
   112,112,112,112,124,0,64,224,266
OC 5010 DATA 112,56,28,14,4,0,62,14,14,14
   ,14,14,62,0,16,56,8470
QZ 5020 DATA 124,238,198,0,0,0,0,0,0,0,0,
   0,255,0,0,0,9529
KE 5030 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,5030
MA 5040 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,5040
NW 5050 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,5050
PS 5060 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,5060
RO 5070 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,5070
TK 5080 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,5080
VG 5090 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,5090
GK 5100 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,
   0,0,5100
LB 5110 DATA 224,2,225,2,3,60,0,0,0,0,0,0
   ,0,0,0,0,6396
```

Listing 2.
BASIC listing.

```
OP 10 REM *** COSMIC GLOB ***
LI 20 REM CASSETTE MAKER PROGRAM
EI 40 DIM DAT(16):LINE=990:RESTORE 1000:T
   RAP 120:? "CHECKING DATA"
DO 50 LINE=LINE+10:? "LINE:";LINE:FOR X=1
    TO 16:READ DAT:IF DAT<0 OR DAT>255 TH
   EN 220
YY 60 DAT(X)=DAT:NEXT X:DATLIN=PEEK(183)+
   PEEK(184)*256:IF DATLIN<>LINE THEN ? "
   LINE ";LINE;" MISSING!":END
WP 70 TOTAL=LINE:FOR X=1 TO 16
HM 80 IF PASS=2 THEN PUT #1,DAT(X):NEXT X
   :READ CHKSUM:GOTO 50
AJ 90 TOTAL=TOTAL+DAT(X)*X:IF TOTAL>9999
   THEN TOTAL=TOTAL-10000
LR 100 NEXT X:READ CHKSUM:IF TOTAL=CHKSUM
    THEN 50
MO 110 GOTO 220
ZR 120 IF PEEK(195)<>6 THEN 220
ZT 130 IF PASS=0 THEN 200
AD 160 FOR X=1 TO 128:PUT #1,0:NEXT X:CLO
   SE #1:END
SD 200 ? "READY CASSETTE AND PRESS RETURN
   ";:OPEN #1,8,128,"C:":RESTORE 230:FOR
   X=1 TO 40:READ N:PUT #1,N:NEXT X
QS 210 ? :? "WRITING FILE":PASS=2:LINE=99
   0:RESTORE 1000:TRAP 120:GOTO 50
MI 220 ? "BAD DATA: LINE ";LINE:END
ZQ 230 DATA 0,52,210,59,249,59,169,0,234,
   234,234,169,60,141,2,211,169,0,141,211
   ,2,133,14,169,86,141,232,2
GO 240 DATA 133,15,169,3,133,10,169,60,13
   3,11,24,96
```


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DLIs

Another minute to learn

by Jonathan David Farley

Last month was the easy part. Now, you can control the (almost) omnipotent display list. Good for you. But don't start thinking about new ideas for your next arcade video game just yet! You still don't know (at least, not from me) what a DLI or—dare I say it?—display list interrupt is. Now that you know about displays lists, read on and find out about DLIs; the concept isn't as complex as you might think.

DLI talk.

A DLI is like a subroutine. The display list command equivalent of GOSUB is *128*; add 128 to the display list byte and you have it.

For instance, the computer sees a byte of *130* at DL+16 (where *DL* equals the address of the display list) and says, "Gee, here's another ANTIC mode 2 line. . . but what's this? An extra *128*? I see: the big guy out there wants me to do something. I guess I'll have to finish up what I'm doing now (which happens to be this mode line) and go to it. Then I'll come back and do the next line."

The computer needs to know where in memory the subroutine is; locations 512 and 513 handle that. You must also "turn on" the DLI by poking a *192* into the register NMIEN (decimal *54286*).

Save our registers.

DLIs are subroutines, but they're not written in BASIC. They're done in machine language. The first instructions in the DLI subroutine must save the computer's three special registers, called X and Y, and the Accumulator, or A. Why must we save the contents of these registers? When your DLI is finished and returns control to the main program, the computer expects to have everything just the way it left it. There may have been important data in those registers, and you surely changed them when you performed your DLI.

A DLI.

Sometimes, instead of waiting till the end of a line to start a DLI, ANTIC gets a little ahead of itself. If you use your DLI to change, perhaps, the background color, it will sometimes start changing the color mid-line, producing a ragged boundary (that shakes and changes position annoyingly) between one color and the next; on the same line.

By storing any nonzero value into a location named WSYNC at $D40A (the symbol for the dollar indicates a base sixteen, or hexadecimal, number) or 54282 decimal, you tell ANTIC, "Don't do this DLI until the horizontal blank."

Remember the horizontal blank? When the color is changed during the blank, you're ensured the new color will start on the following mode line.

```
*=$0600
PHA
TXA
PHA
TYA
PHA
LDA #$FF
STA $D40A
LDX #$0
STA $D017
STX $D018
PLA
TAY
PLA
```

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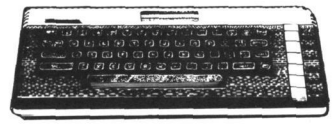

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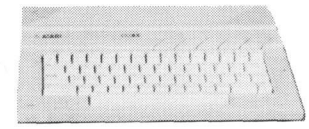

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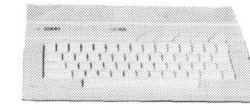

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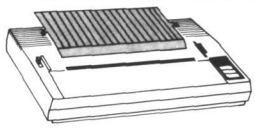

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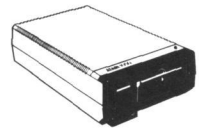

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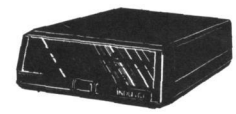

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CIRCLE #142 ON READER SERVICE CARD

```
TAX
PLA
RTI
```

The ** =$0600* tells the computer to put the first byte of the program into location $0600 or 1536 decimal, with the rest of the program following. Commonly called page 6, this area (256 locations of RAM) is set aside for the programmer's use.

The next five mnemonic statements save the registers. The accumulator is "pushed" (saved in yet another memory area called the stack). The X- and Y-registers are, in turn, transferred to the accumulator and pushed onto the stack. And the end of the DLI, the register values are pulled back (in the reverse order of the way they were saved) and transferred back to their respective registers. (Just like logs piled onto a stack; the last log placed will be the first one taken off.) After all this, the computer returns from the interrupt and resumes going through the display list—like a BASIC RETURN.

At the start of the actual DLI, the computer loads the accumulator with *$FF* hexadecimal (255 decimal). It stores this number into memory location $D40A, WSYNC. Since this DLI changes the color of the screen, it should start doing so only after the horizontal blank for a clean switch of color. It also loads X with *$0*. It stores these registers' values in locations $D017 and $D018. You may ask, "So what?"

Poking shadows the hard way.

You may be aware of RAM locations 709 through 712, which determine the screen colors. The byte values in these locations are combinations of luminances and hues, to produce a myriad of shades and colors. These, however, are but shadows of the hardware locations the computer keeps for its own use.

Sure, you can POKE values into hardware locations, and, yes, the screen color does change. However, the screen is updated sixty times per second, and the computer gets the screen color from the shadows. End result: the screen flickers to your color, then, one-sixtieth of a second later, it's business as usual, switching back to the color in the shadow location.

Locations $D017 and $D018 are the hardware registers for locations 709 and 710. These registers keep track of the character and background colors, respectively. So. . .when the DLI routine stores the values in the A- and X-registers into these hardware locations, it's changing the color of the screen.

You may ask, "Yeah, but won't it just flicker back to the color in shadow registers?" Not at all, because you're going to keep poking that hardware register sixty times a second. The DLI is executed just as often as the computer draws the display. So the screen below the mode line with the DLI is the color you're placing in the hardware register. After the vertical blank (when this sort of thing is also done), the hardware register will again be set from its shadow, and hence the screen (up to the line with your DLI) will be normally colored—until the DLI comes around once more, that is. It changes the hardware locations, and everything starts over again (and again).

```
10 GRAPHICS 0
20 DL=PEEK(560)+256*PEEK(561)
30 FOR A=1536 TO 1539
40 READ B:POKE A,B:NEXT A
50 POKE 512,0:POKE 513,6
60 POKE DL+16,130:POKE 54286,192
70 DATA 72,138,72,152,72,169,255,141,1
0,212,162,0,141,23,208,142,24,208,104,
168,104,170,104,64
```

The *DATA* is the DLI POKEd into page 6. The DLI is in machine language, the result of assembling our assembly listing.

First, the program will find display list's start, POKE the DATA, and tell the computer where to find the DLI (*6*256+0 =1536*). ANTIC is told to interrupt after the mode line at DL+16, about halfway down the ANTIC 2 screen, and, finally, NMIEN is set to enable the DLI.

Here's a correlation between the DATA and the assembler routine: 72=PHA, 138=TXA, 152=TYA, 169=LDA with the following byte, 141=STA into the following 2-byte address (the first byte plus 256 times the second), 162 =LDX with the following byte, 142=STX into the following 2-byte address, 104=PLA, 168=TYA, 170=TXA, 64= RTI. There you go!

Whether you exclaimed, "Awesome!" or yawned, "Quite trite," I've got some advice.

DLIs are comparable to enclitics on words, or catalysts in chemical reactions—by themselves, they're virtually useless, but, combined with other techniques, they're extremely powerful. The stars are made of atoms, a brain of cells, and a computer (essentially) of bits. What I'm trying to tell you is: learn about your Atari.

Mirror Mirror on the screen.

For now, though, you can still do some "wild and crazy" things. Did you really believe I would leave out something to pop your eyes?

The program *Mirror Mirror* is shown in BASIC (Listing 1) and assembler (Listing 2).

The DLI at $0600 changes the screen color hardware registers, makes sure the characters are right side up, and puts the characters from the bottom half of the screen onto the top. Let's see how it does this, via a detailed examination of the assembler code.

The **=$0600* informs the computer to place our DLI program into memory, starting at location $0600 (1536 decimal). The program then saves the registers and loads them with new values (after taking care of WSYNC). These new values are stored into locations $D017, $D018, and $D401.

What does location $D401 do?

In *Mirror Mirror*, $D401 (CHACTL) is used to cause the "flip effect;" it makes the characters appear upside down. Since I changed the hardware register (only hardware locations are usually used in DLIs, as I mentioned earlier), only the area of the DLI will be affected. CHACTL normally contains the number *2*. By putting a *6* into it, the letters are flipped.

The most important of this DLI's functions: it must take all the characters on the bottom half of the screen and put them on top, overlapping whatever else may already be there. Remember, the screen RAM is composed of 960 bytes and starts at location 40000 (in a 48K machine). Fur-

thermore, each byte represents a character. 40 bytes represent one line of text.

The bottom twelve lines of text are the last 480 bytes; to mirror them, we must put the bytes of locations 40480-40959 (the bottom twelve lines' worth of characters) in their logically corresponding positions on the top half. The byte, and hence the character, in 40959 for instance, would be flipped into 40040—the vertical opposite but horizontal equal on the screen.

All that part three of the DLI does is load a byte from the location given, plus the value in X. For each new line, X is loaded with #0 and incremented after each byte stored. After every byte, the machine compares X to 40, to see if the whole line has been copied. The computer branches if X is not equal to 40, to do another byte.

Just before the computer pulls the registers back and returns to where it was prior to the interrupt, it does one more task: the DLI stores a $0 in 512 and a hexadecimal $40 (decimal 64) into 513. Locations 512 and 513 are the address of the DLI handle, remember? The computer reads these locations to find out where the DLI is when it encounters a DLI instruction in the display list. So, the next time your computer is told to interrupt the display list (in less than one-sixtieth of a second), it goes to 64*256+0 = 16384 or $40*$ff+$0=$4000.

This second DLI also stores the values of A and X into the hardware color registers; these colors are different from those in the first DLI. In CHACTL, a 6 is stored from Y. This value in $D401 makes all characters under the DLI's influence appear flipped.

As with the first, this DLI has something that makes it special. The earlier DLI moves the bottom of the screen to the top. Because of this, anything typed on the top is changed to its bilateral counterpart on the bottom sixty times every second, erasing whatever you typed. Basically, you can't put anything on the top, though nothing stops the cursor from going there. This presents some problems in cybernetic aesthetics—easily solved problems, of course.

The DLI at $4000 cuts the screen's vertical length by two, as if something just crunched the screen together. This was done so the cursor could not go into the top, where it was useless. The display is still a normal screen, but only the last 480 bytes are displayed (and mirrored).

A certain memory location, $54 (84), has a value equal to the vertical position of the cursor. When humans count, they say, "One, two. . . .ten." Your logical Atari, though, says, "Zero, one. . . .nine." If PEEK(84)=0, the cursor's in the topmost row of the screen; if it is equal to 23, it's at the bottom. When you use the CTRL-ARROW key, the cursor goes to Line 23 when you go "over" the screen past Line 0, and to Line 0 when you go "below" Line 23. Location $54 changes accordingly.

Your friendly DLI at $4000 is on the lookout for $54. It constantly loads it into the accumulator and compares its value, to see if it's in the dreaded top half. It is, as I said, compared to $B (11 decimal). If the value in A (which is the value in $54) is equal to $B, a branch similar to a BASIC GOTO is taken, to TRTN. At TRTN, the accumulator is loaded with 0 and stored in $54. Since the value in $54 is the screen row of the cursor, the result is that, when the cursor gets to row 11, it's put in row 0. The next statement loads A with the ATASCII value of the ↑ function.

ATASCII values of characters are used in a system subroutine that starts at $F6A4 (Note: this address was changed on the XL and XE computers. For that reason, the cursor routine in the program won't function on these computers, unless a translator disk i loaded.) This subroutine prints the character whose ATASCII value is in the A-register. In this case, the character printed is the one that moves the cursor upward—since it's on Line 0, it would, after this, be on Line 23.

Why didn't I just put a *23* in $54 as soon as it got to #$B? One of the problems that had to be overcome was that, until a key is pressed, the cursor cannot be seen right after location $54 is changed. I solved it by "pressing" a key with the subroutine at $F6A4.

At the end of the DLI, the locations 512 and 513 are changed to *$00* and *$06*, so the next time the computer encounters a "go to DLI" instruction in the display list, it will go to the one at $0600.

The program here gets the location of the display list

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CIRCLE #177 ON READER SERVICE CARD

from 560 and 561, and puts it in 203 and 204. It loads A with *$F0*—that's 112+128=240. It also loads Y with *2*. The *STA (203),Y* means, "Add the value in Y to the address stored in 203 and 204, and store the value of A in the resultant address." We know the resulting memory location to be 2 bytes from the first byte in the display list, or DL+2. Since the first three instructions (DL+0, DL+1, and DL+2), each create eight blank lines, we must store *240* into the last one. Normally, DL+2 is *112*, but a *128* added to it gives *240*. When ANTIC comes to that, it knows it should execute a DLI. A second interrupt at DL+16 is staged. Since this location is normally an ANTIC mode line of two, it's now *130*. Finally, this program tells the computer where to go for the first interrupt (the location is stored in 512 and 513). After that, a *$C0* (or 192) is stored in MNIEN, *54286*. When that's done, it goes like clockwork!

The end—at long last.

Finally, you know all about DLIs. You've even explored some genuine assembler programs. It may have taken a bit longer than a minute to learn, but you have a lifetime to master it.

The two-letter checksum code preceding the line numbers here is *not* a part of the BASIC program. For further information, see the *BASIC Editor II* in issue 47.

Listing 1.
BASIC listing.

```
RL 0 POKE 559,0:DATA 0,1,2,3,4,5,6,7,8,9,
   0,0,0,0,0,0,0,0,10,11,12,13,14,15
BZ 10 FOR A=1536 TO 1790:POKE A,0:NEXT A:
   FOR A=16384 TO 16639:POKE A,0:NEXT A:F
   OR A=24576 TO 24831:POKE A,0
OJ 20 NEXT A:DIM A(23),A$(1000),B$(120)
TE 30 FOR A=1 TO 23:READ B:A(A)=B:NEXT A
KH 40 FOR A=1 TO 5:READ B$:A$(LEN(A$)+1)=
   B$:NEXT A:B=1536:GOSUB 10000
PA 50 READ B$:A$=B$:READ B$:A$(LEN(A$)+1)
   =B$:B=16384:GOSUB 10000
QD 60 READ A$:B=24576:GOSUB 10000:POKE 55
   9,34:A=USR(24576)
SG 70 ? "K":POSITION 10,12:? "**********
   **********":POSITION 10,16:? "********
   **********"
KA 80 POSITION 10,13:? "*  MIrROR    MiRR
   Or *":POSITION 10,14:? "*          by
        *":POSITION 10,15
VL 90 ? "* Jonathan  Farley  *":STOP
SP 1000 DATA 488A489848A9808D0AD4A2FFA002
   8D17D08E18D08C01D4A200BDD89F9D409CE8E0
   28D0F5A200BDB09F9D689CE8E028D0
PW 1010 DATA F5A200BD889F9D909CE8E028D0F5
   A200BD609F9DB89CE8E028D0F5A200BD389F9D
   E09CE8E028D0F5A200BD109F9D089D
RS 1020 DATA E8E028D0F5A200BDE89E9D309DE8
   E028D0F5A200BDC09E9D589DE8E028D0F5A200
   BD989E9D809DE8E028D0F5A200BD70
CV 1030 DATA 9E9DA89DE8E028D0F5A200BD489E
   9DD09DE8E028D0F5A200BD209E9DF89DE8E028
   D0F5A9008D0002A9408D010268A868
HE 1040 DATA AA6840
YT 2000 DATA 488A489848A9FF8D0AD4A280A006
   8D17D08E18D08C01D4A554C90BF010C900D015
   A90B8554A91D20A4F64C3640A90085
RX 2010 DATA 54A91C20A4F6A9008D0002A9068D
   010268A868AA6840
SM 3000 DATA 68AD300285CBAD310285CCA9F0A0
   0291CBA982A01091CBA9008D0002A9068D0102
   A9C08D0ED460
XQ 10000 FOR A=1 TO LEN(A$) STEP 2:D1=A(A
   SC(A$(A,A))-47):D0=A(ASC(A$(A+1,A+1))-
   47):D=D1*16+D0:POKE B,D
DK 10010 B=B+1:NEXT A:RETURN
BK 10020 REM
BO 10030 REM
BS 10040 REM
DL 10050 REM This program turns off ANTIC
   so it may RUN faster without worrying
   about what's on the screen.
GK 10060 REM It loads the DLI's in $6000
   (1536) and $4000 (16384), and the main
   program in $6000 (24576).
YI 10070 END
```

Listing 2.
Assembly listing.

```
0100 ;**********************
0110 ;*  MIrROR    MiRROr *
0120 ;*         by         *
0130 ;* Jonathan  Farley  *
0140 ;**********************
0150 ;
0160 ;
0170 ; This DLI places the registers
0180 ;on the stack, LoaDs "A" with
0190 ;the characters' color and
0200 ;STores it in WSYNC for a clean
0210 ;change.  It also gets the
0220 ;characters' background color in
0230 ;"X" and the "no-flip" value in
0240 ;"Y," which are STored
0250 ;appropriately.  Then, line by
0260 ;line, byte by byte, it copies
0270 ;the characters on the bottom
0280 ;to the top.  It makes sure the
0290 ;next DLI the computer goes to
0300 ;is at $4000, and it gets back
0310 ;the registers.
0320     *=  $0600
0330     PHA
0340     TXA
0350     PHA
0360     TYA
0370     PHA
0380     LDA #$80
0390     STA $D40A
0400     LDX #$FF
0410     LDY #$02
0420     STA $D017
0430     STX $D018
0440     STY $D401
0450     LDX #$00
0460 ONNE LDA 40920,X
0470     STA 40000,X
0480     INX
0490     CPX #40
0500     BNE ONNE
0510     LDX #$00
0520 TWWO LDA 40880,X
0530     STA 40040,X
0540     INX
0550     CPX #40
0560     BNE TWWO
0570     LDX #$00
0580 THRE LDA 40840,X
0590     STA 40080,X
0600     INX
0610     CPX #40
0620     BNE THRE
```

(continued on page 130)

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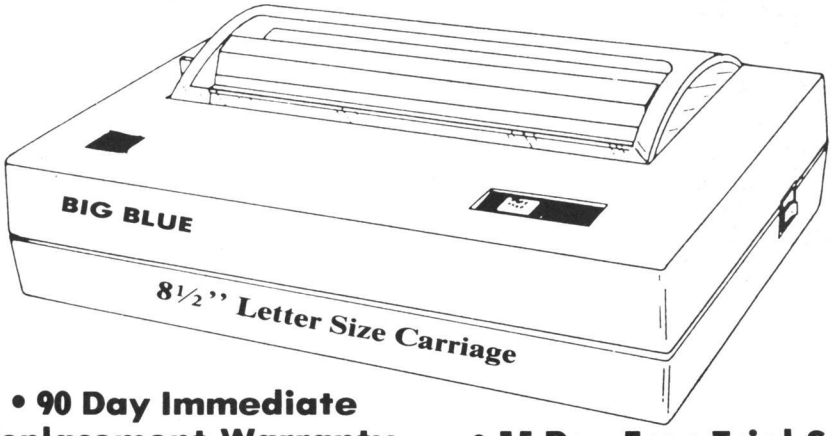

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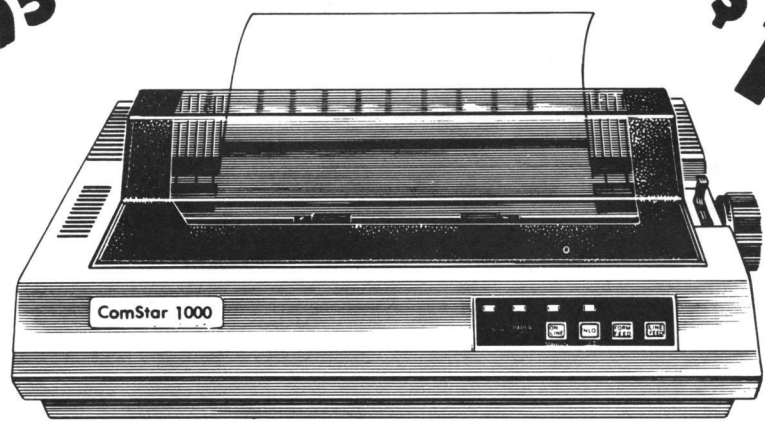

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Panak strikes!

Reviews of the latest software

by Steve Panak

For too long Atari has played second fiddle.

Like a pathetic, quickly forgotten B-side song, Atari has been forced to dance to Commodore's lead. Regardless of the past, the trends of the last few months indicate that something has got to give. There *will* be change.

The fact that I'm currently testing a game with Atari on one side and Apple on the other supports this line of thought. However, this is only specualation. What is fact, though, is the existence of the games which follow. I hope you find something that suits you.

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It was bound to happen. Once a device is replaced by a "new and improved" version, the price of the old model plummets After the hardware prices drop. so do the tickets on the various support products—in this case, software.

In the past few months, we've seen a reduction in 8-bit software prices. The average price hovers somewhere around the mid-twenties, down from the mid-thirties of a year ago. So, in salesman's terms, you can now buy about 1.3 games for the price of 1. What you're going to do with the .3 game is a mystery to me.

Of course, you could buy one of these budget titles. But if you do, you'll only end up with about a third of a game. This is because these cheapies are just what you might expect them to be: rehashes of the old, tired concepts and themes, enclosed in substandard graphics and dull packaging. The attempt here is to cut costs—and it shows.

Of the four games tested, my favorite was the slot machine of **Vegas Jackpot**. Combined with a potpourri of games of chance. the slot machine would have rounded out a nice package; alone, it's a boring waste. Without anything at stake gambling loses most of its appeal. so this one-armed bandit leaves you feeling robbed. However, as poor as this program was, the others were even bigger losers.

I also looked at **Action Biker** and **Kikstart**, two motorcycle simulations. and **The Last V-8**, a car-racing game. This last was the most inventive. You're a post-nuclear-holocaust scientist who takes his car, **The Last V-8**, onto the surface. to make contact with the last remnants of mankind. It's a rather creative scenario, especially when contrasted to the simplicity and predictability of the other three games. Unfortunately. like the others, **The Last V-8** crashes and burns in flames. . and hardly a tear is shed.

For those of you who want the grisly details, here goes. **Action Biker** jumps over things, usually not very well. **Kikstart** races around town, picking things up for points. And **The Last V-8** simply keeps running off the road. That's about all I I can tell you about them—the amount of time they held my attention could be measured in seconds. The disks have gone on to be used for a much nobler purpose: holding the words I now write for you. I do remember that some of these games have variable difficulty levels and allow for more than one player, although I could persuade no one to join me.

Their graphics really aren't too bad, if you're after old 2600 images, conjured from some Californian silicon cemetery. If that's not what you want, don't bother. And as for control, there was none—or at least it seemed so. I hate to fight with a joystick, attempting to translate normal movement into some sort of jerk or twitch the program code will recognize as a successful maneuver. The games handle like old, overloaded 2600s—tired and out of date.

All four games are packaged cheaply, almost generically. Simple plastic portfolios hold the disks, while paper sheets inserted in the sleeves contain cover art and instructions. Inside, in addition to the disks, may be additional documentation and ad-

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CIRCLE #179 ON READER SERVICE CARD

ditional documentation and advertisements for other games. Translations to other languages indicate an overseas market. Perhaps standards are lower in other countries.

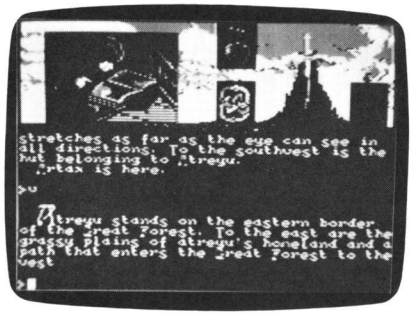
Although the flippies (floppies with the Atari version on one side, Commodore on the other) are clearly labeled to prevent placing the wrong side in your drive, instructions for the Atari version are not to be found. Fortunately, booting goes easily—if you've ever booted a program before. If you haven't, good luck. And, if you think you'll be told how to play, you're mistaken. These games are truly for experimenters.

While they might be big sellers overseas, I can almost guarantee they won't be here. Even though the price is right, the games offer little in value and cannot be recommended, except for a special enemy on your holiday list. Even if these are the only games you can afford, you're better off saving up for a really good buy.

The NeverEnding Story

by Ian Weatherburn
DATASOFT
19808 Nordhoff Place
Chatsworth, CA 91311
64K Disk $29.95

Here we go again—when all ingenuity and creativity fail, parade out the movie tie-ins. Similarly, it's hardly a new idea to have an adventure game where you control movement through a seemingly open-ended story. Adding pictures to the plot is also often tried, although it nearly always detracts from the main objectives of plot and character development. The saying that a picture is worth a thousand words, while true, is only a generalization, and does not apply in all situations—especially where both must exist in a very finite amount of screen area).



The NeverEnding Story.

Add all of these time-tested and world-weary ingredients together and you have **The NeverEnding Story**, a trite piece you'll soon wish would end. In a vacuum, this game might be acceptable, but there are simply too many great programs out there. The damsel-in-distress theme is a dead skeleton on which is hung little plot. Since I didn't see the movie, I can't tell you how closely it was paralleled, but this story is pretty predictable.

I did see the graphics, and I must report that they're creative. The screen is split into windows, one showing the area you're in, one the results of your latest command, and others opening up to display inventory as you obtain items and acquaintances. These final windows eliminate any need for the time-consuming inventory command issued just in time to find out you're carrying too much (only five items at any one time) as you fumble for the sword.

Unfortunately, these graphics occupy about half of the screen horizontally, cutting down the detail and leaving little room for limericks. In adventures it's often useful to view previous text, and a couple of lines is not enough.

But, while the graphics were rather nice and convenient, the text was virtually unreadable. Reading text on a 40-column screen is always trying, but this game creates eyestrain. Although the prose wasn't too bad, I never really became interested, probably due to poor characterization. The simple subject-verb commands are obsolete (it *is* almost 1987, isn't it?), and the vocabulary is limited. The game ends up being a treasure hunt, in which you pick things up and try to find uses for them.

On my new 65XE, the first game I tested didn't run. However, the second disk did fine. Since the game requires 64K, the 800 is out (although booting up on an 800 results in an interesting audio-visual display). In any other situation, this might be a highly undesirable narrowing of the customer base. In this case, it only lessens the number of people potentially disappointed.

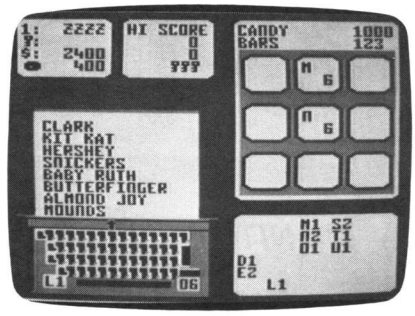
The manual is equally disappointing, a black and white trifold sheet with Commodore/Atari instructions. Hints, a map and the thin thread of a background story line wrap up the documentation. In all fairness, if through some great misfortune, you end up with **The NeverEnding Story**, all is not lost. You'll probably play it and enjoy it—like all software, until you find something better. But, in this case, it won't be soon enough.

Buzzword

by Paul Granchelli
THE BUZZWORD GAME CO., INC.
P.O. Box 440747
Aurora, CO 80044
48K Disk $39.95

Because of my *occasional* ruthless nature, games aren't always voluntarily made available for my reviews. Fortunately for consumers, I can root most of these out, and sometimes the search itself has the beneficial side effect of increasing the intensity of my scrutiny.

This month, I received a game with a letter expressing trepidation at the prospect of allowing me to sink my fangs into it. It's a trivia game, **Buzzword**. If the manufacturers knew how much I hate trivia games, they'd never have sent it. That would have been a crime, since I would never have obtained it myself—despite my prejudice, I must give it a thumbs-up.



Buzzword.

The game is less a trivia game than a computerization of the old TV game show *Family Feud*. Given a category, one or two players try to guess words formed from letters displayed in a distribution pool. Additional clues are possible, such as the first letter of a word and/or the number of letters in the word. The three difficulty levels force you to guess at everything from common words to obscure slang, and one or two persons or teams may play at a time.

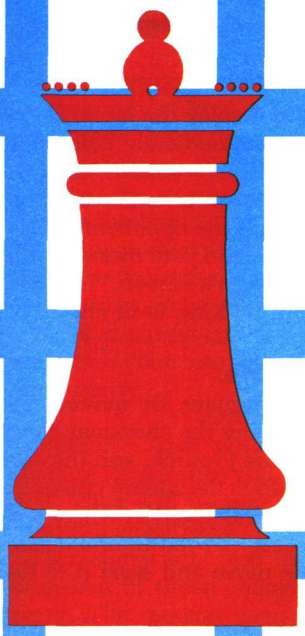
Supplementing the game are cards similar to those of trivia games. These give a more complete description of the category, such as "No Nutrition" (things, other than food, that people put in their mouths). We especially enjoyed the category "Buzzword Connection," featuring words with a given prefix. This was often difficult, since the prefix *sea* might contain the words *seahorse* and *search*.

The object of the game is to guess words, earn points and win with the highest score. A pot builds, and there's a bonus round—familiar scoring fixtures from game shows. Do you try to guess just one more word—and risk missing, giving the pot to your opponent—or should you pass and collect a slightly smaller pot? Like most great games, there are more than enough opportunities for strategy.

The screen is set up nicely, with clues and letter distribution displayed on the right, and scoring data on the upper left of the screen. The bottom left contains an animated typewriter, on which guessed words are printed. While the display may not have the highest-quality graphics I've ever seen, it *is* legible—and, in a word game, that's very important. All control is through the keyboard; your team's best typist should input the answers. After typing in the card number, clues (if any) are displayed, and you begin guessing words.

As for difficulty—the game is tough.

(continued on page 131)



Modem Chess

Makes it easy to play chess with a telephone partner.

by Gary Heitz

Chess is a game of skill. It's unlike most other parlor or board games, in that luck doesn't play a factor in the outcome. There are no cards or dice to decide who has an advantage. Chess is, really, a game of war. Opponents fight for strategic positions and attack each other's forces. The object of the game is to capture the opposing king.

Now, with **Modem Chess** booted, you and another player can have at it, long-distance. Both of you must have: an Atari computer (400, 800, XL, XE); a modem (1030, 835, MPP 1000C/E, others); one joystick; 48K of RAM; Atari BASIC; and a copy of **Modem Chess**.

Typing it in.

Type in Listing 1, using **BASIC Editor II** (see issue 47). Save the program as *"D:MDMCHSS1.BAS"*, then type *NEW* and RETURN to clear your computer.

Type in Listing 2, again using **BASIC Editor II**. Save this program under any filename and run it. This will create a file on the disk called MDMCHESS.DAT. It contains the lines that are too difficult to enter from the keyboard.

Load Listing 1 with the command *LOAD "D:MDMCHSS1.BAS"* Now, merge the second listing by typing *ENTER "D:MDMCHESS.DAT"*. You now have the running version of **Modem Chess**. Type *SAVE "D:MDMCHESS.BAS"* and press RETURN.

Getting started.

Once the person you wish to play chess with has a copy

of **Modem Chess**, you're ready. It's suggested that you call your opponent on voice, to allow each of you time to set up—and to determine who'll originate the game call.

After voice contact has been made, so that you're organized, turn on the modem, then the disk drive and your monitor or TV. Place a disk that will automatically load a modem handler into the drive and turn on your computer.

After your modem handler has loaded and BASIC's *READY* prompt appears, remove that disk and insert the one containing **Modem Chess**. Type *RUN "D:MDMCHESS.BAS* and hit RETURN.

When **Modem Chess** begins, you'll see the title screen, and be asked to type your name (a maximum of ten characters). If you have a data disk for **Modem Chess**, this is the time to insert it into your drive. Enter your name and press RETURN.

Within a few seconds, the screen will clear and you'll be in the "dial/answer" mode. Here, the screen will display the directory listed on your data disk. If you have no directory on the disk, no phone numbers will appear.

The bottom of the screen will display this menu:

Type: 0-9, Manual, Answer, Originate,
Next page, Increase, Edit

These options are explained as follows: first, the numbers highlighted after the prompt *Type:* correspond to the numbers given in the phone list on the same screen. If there are no numbers listed, these highlighted numbers will not appear.

The next option allows you to type in a phone number manually, to be dialed by your computer. Simply type the letter *M* to begin this process.

The third option is used for answering a call. It's best to wait until you hear one full ring of the telephone before you press the *A* key. This will increase your chances of connecting the first time. If for some reason connection is not made, you'll be returned to this menu, where you may try again.

Press the *O* key to originate the call. If you're actually talking to the other player—and **Modem Chess** is installed in both computers—one player may press *A* for answer and the other *O* for originate. In this way, you don't have to hang up and redial. This option won't work if both modems are MPPs.

The *N* option is used to go to the next page of the phone directory. If there aren't enough numbers on the disk to warrant a second (or third, etc.) page, then you'll be returned to the first page.

The last two choices allow you to create, increase and edit the telephone directory on your disk. Press *I* to create or increase the list. Use *E* to correct a name or phone number that's already in the directory.

After your computer has made the connection, there'll be a brief pause. The screen will clear and you'll be in a full-screen terminal mode. Here you can converse with the other player by typing on your keyboard.

When you're ready to begin your game, only one player need press the START button. Both computers will then randomly select which player will have the white pieces and which black. After this, the screen will display the chessboard.

Playing Modem Chess

The top line of the screen will display the name of the person who is to make a move. Immediately below the chessboard is a line that states *OPTION=MENU, SELECT =SETUP.* At the bottom of the screen is a conversation window, used to communicate with the opponent during play. Simply type on your keyboard, and your message will also be displayed on the other player's screen. This can be used to warn the player that his king is in check, or that checkmate has occurred.

Making a move.

The cursor is in the shape of a square. By moving the joystick, you position the cursor over the chessman to be moved. Press the red button on the joystick, and the cursor will change to a solid box. Move the square cursor by moving the joystick controller to the position where you want the piece moved, then press the red button again. Your computer will execute the move and send it to the other player.

When you receive a move, the monitor's speaker will sound two beeps, to alert you that a move is coming. Your cursor will move to the position where the opponent's chess piece was. The piece that was moved will flash in its new position for a few seconds. If you wish to stop the flashing, simply type on the keyboard, move the joystick, or press the red button.

The game continues in this manner, with players alternating turns.

Options.

As was mentioned, the line immediately below the chessboard says *OPTION=MENU SELECT=SETUP.* This line will display a menu if the OPTION button is depressed.

The menu shows: *Return, End, Save, Load* and *Take back move.* Simply press the first letter of the desired option (*R, E, S, L,* or *T*). For instance, hitting *R* allows you to exit the menu and return to the game, if you don't wish to make a selection from this menu.

Pressing the letter *E* will allow you to end the game. This option should only be used if both players have agreed that the game is over. The screen will be cleared, and you'll be back in the full-screen terminal mode—as you were before the game started. There you may converse again, disconnect, or begin a new game.

The third option, *S*, will save the position of the chessmen to your disk drive. This feature is useful if you can no longer continue the game, but wish to finish it at a later date.

The *L* option will load the game that was previously saved. The position of the pieces will be loaded from your disk drive, then transmitted to the other player's computer.

The last option here is the *T*, or *Take back move*, option. If you accidentally make an illegal move, or for any reason need to take back the last move you made, pressing the letter *T* will reconstruct the chessboard in the former positions. It will then send the corrected board to the other computer. This can only be used *after* your move,

since—obviously—you cannot take back the other player's move.

Instead of pressing the OPTION button for the menu, you may press SELECT to set up the chessboard. You may never need to use this option, yet it's there—just in case. To use it, press SELECT and answer *Y* to the prompt.

To use the set up mode, move the cursor over the position on the board that needs altering. Press the red button on the joystick to cycle through the available chessmen. Once the desired piece appears, move your cursor to the next position to be changed and do the same. Once you've completed setting up the board, press SELECT again. This will cause your computer to send updated positions to the other player.

Other information.

Modem Chess will readily accept such moves as Castling (make sure you move the king first) and En Passant. They will be sent as two separate moves and will require a short delay.

Each signal sent over the modem is checked, with the exception of those characters entered through the keyboard. The method used is similar to that of XModem, but is more rigorous. Even so, as with XModem, it's possible that, even after repeated attempts to send a move or the board positions, the phone lines may continually garble the information. If this should happen, it's suggested that you turn off your computer and redial the other player.

Some excellent modem handlers in the public domain are *R.BIN* by Joe Miller and Russ Wetmore, and any of the Chilcott handlers (HMDRV.XMO, MDRIVE.XMO and SMDRV.XMO). These can be obtained from CompuServe and many BBSs, under the above filenames.

A special thanks to Richard Shier. Without his help and patience, this program would not have been possible.

The two-letter checksum code preceding the line numbers here is *not* a part of the BASIC program. For further information, see the *BASIC Editor II* in issue 47.

Listing 1.
BASIC listing.

```
NH 20 POKE 580,9:GOTO 4410
KU 30 REM *** RECEIVE ***
VF 40 REM *** LENGTH ***
IV 50 SIG=C0:FOR W=C1 TO 200:GOSUB CKIN:I
   F IN THEN GET #MOD,X:GOTO 70
LX 60 NEXT W:GOTO 90
NH 70 IF SIG=C0 THEN SIG=X:GOTO 60
ET 80 POP :IF SIG=X THEN 100
ZK 90 PUT #MOD,C1:PUT #MOD,C1:GOTO RECEIV
   E
XC 100 IF SIG>100 AND SIG<>162 THEN 90
UB 110 PUT #MOD,OK:PUT #MOD,OK
SW 120 REM *** GET S$ ***
ZX 130 GOSUB CLRBUF
IT 140 S$="":SUM=C0:FOR I=C1 TO SIG+C2:TO
   UT=C0
DM 150 GOSUB CKIN:IF IN THEN GET #MOD,X:S
   UM=SUM+X:S$(LEN(S$)+C1)=CHR$(X):GOTO 1
   80
PS 160 TOUT=TOUT+C1:IF TOUT>200 THEN POP
   :GOTO 210
NX 170 GOTO 150
GH 180 NEXT I
AH 190 A=ASC(S$(LEN(S$)-C1)):B=ASC(S$(LEN
   (S$))):SUM=SUM-(A+B):SUM=ASC(CHR$(SUM)
   )
GZ 200 IF A=B AND SUM=A THEN PUT #MOD,OK:
   PUT #MOD,OK:GOTO 220
FQ 210 PUT #MOD,C1:PUT #MOD,C1:GOTO 130
FB 220 IF OFF THEN RETURN
LO 230 GOSUB SOUND:GOTO SOUND
BN 240 REM *** CKIN ***
NP 250 IN=C0:STATUS #MOD,X:IF PEEK(MSTAT)
    THEN IN=C1
ZK 260 RETURN
YQ 270 REM *** IO ***
VI 280 POKE 205,235:POKE 206,C2:IF MDM=C2
    THEN POKE 205,C0:POKE 206,C4
DT 290 SIG=USR(ADR(MOD$)):IF SIG<C128 THE
   N RETURN
QO 300 GOTO CKSIG
CV 310 REM *** SEND ***
PM 320 SIG=LEN(S$):GOSUB SIGNAL
QD 330 GOSUB CLRBUF:SUM=C0:FOR I=C1 TO LE
   N(S$):A=ASC(S$(I,I)):PUT #MOD,A:SUM=SU
   M+A
CY 340 IF LEN(S$)>C32 THEN FOR W=C1 TO C5
   :NEXT W
CC 350 NEXT I:SUM=ASC(CHR$(SUM)):PUT #MOD
   ,SUM:PUT #MOD,SUM
WY 360 A=C0:FOR W=C1 TO 200:GOSUB CKIN:IF
    IN THEN GET #MOD,X:GOTO 380
JH 370 NEXT W:GOTO 400
SI 380 IF A=C0 THEN A=X:GOTO 370
SA 390 POP :IF A=OK OR X=OK THEN RETURN
WL 400 GOSUB CLRBUF:GOTO 330
TS 410 REM *** SUSPEND ***
DG 420 IF MDM=C1 THEN CLOSE #MOD
QX 430 IF MDM=C2 THEN POKE C7,C1:? #MOD;"
   ESZ";:POKE C7,C0
KK 440 IF MDM=C0 THEN XIO 90,#MOD,C0,C0,D
   EV$
ZK 450 RETURN
AB 460 REM *** RESUME ***
MW 470 IF MDM=C1 THEN GOTO TERM
SL 480 IF MDM=C0 THEN XIO 89,#MOD,C0,C0,D
   EV$
WS 490 IF DEV$="R:" THEN XIO 36,#MOD,C0,C
   0,DEV$
VU 500 IF MDM=C2 THEN POKE C7,C1:? #MOD;"
   EYEA";CHR$(32);"♥";:POKE C7,C0
ZD 510 RETURN
HO 520 REM *** TERMINAL SETUP ***
CD 530 GOSUB SUSPEND:TRAP TERM
KB 540 IF MDM=C2 THEN GOSUB RESUME:RETURN
EM 550 XIO C32+C4,#MOD,C8,C0,DEV$:XIO 38,
   #MOD,C32,C0,DEV$:XIO C32+C2,#MOD,192,C
   0,DEV$
KB 560 IF MDM=C0 THEN GOSUB RESUME
AA 570 IF MDM=C1 THEN OPEN #MOD,13,C0,DEV
   $
OB 580 XIO 40,#MOD,C0,C0,DEV$:TRAP ERROR:
   RETURN
OT 590 REM *** SIGNAL ***
ZW 600 GOSUB CLRBUF
UT 610 PUT #MOD,SIG:PUT #MOD,SIG
WB 620 CK=C0:FOR I=C1 TO 200:GOSUB CKIN:I
   F IN THEN GET #MOD,X:GOTO 640
AX 630 NEXT I:GOTO SIGNAL
ZV 640 IF CK=C0 THEN CK=X:IF CK<>OK THEN
   630
QJ 650 POP :IF CK=OK OR X=OK THEN RETURN
IA 660 GOTO SIGNAL
LD 670 REM *** CK SIGNAL ***
MD 680 FOR W=C1 TO 200:GOSUB CKIN:IF IN T
   HEN GET #MOD,X:POP :GOTO 700
MF 690 NEXT W:GOTO 710
YA 700 IF SIG=X THEN PUT #MOD,OK:PUT #MOD
   ,OK:RETURN
```

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CIRCLE #181 ON READER SERVICE CARD

```
EG 710 PUT #MOD,C1:PUT #MOD,C1:IF DL=C1 T
   HEN POP :GOTO 990
PK 720 GOTO 280
PW 730 REM *** CLRBUF ***
VF 740 POKE 205,235:POKE 206,C2:IF MDM=C2
    THEN POKE 205,C0:POKE 206,C4
ZP 760 RETURN
BI 770 REM *** DETERMINE MODEM ***
NW 780 MDM=C0:DEV$="R:":FOR I=794 TO 831
   STEP 3
JP 790 IF PEEK(I)=ASC("T") THEN DEV$="T:"
   :MDM=C2
MO 800 NEXT I:RETURN
IP 810 REM *** CONNECT ***
NM 820 CLOSE #C2:? "{CLR}   Connect!  One mom
   ent, please."
SC 830 GOSUB TERM:IF LEN(N2$) THEN 870
WO 840 IF HOST THEN S$=N1$:GOSUB SEND
YZ 850 OFF=C1:GOSUB RECEIVE:OFF=C0:S$(LEN
   (S$)-C1)="":N2$=S$
VF 860 IF HOST=C0 THEN S$=N1$:GOSUB SEND
FT 870 LINE=870:TRAP ERROR
PT 880 GOSUB SUSPEND:GRAPHICS C0:POKE 559
   ,C0:POKE 710,202:POKE 712,194:POKE 709
   ,C0:GOSUB RESUME:GOSUB 5410
JP 890 GOSUB 4520:POSITION C4,C2:? "Press
    START to play MODEM CHESS."
AM 900 POSITION C0,C4:FOR I=C1 TO 40:? CH
   R$(14);:NEXT I:? :? "                - TERMI
   NAL MODE -":? :POKE 559,34
UZ 910 GOSUB 280
SD 920 IF SIG=224 THEN 960
UK 930 IF PEEK(CONSOL)=C6 THEN SIG=224:GO
   SUB SIGNAL:GOTO 960
PJ 940 GOTO 910
XT 950 REM *** FIND HOST ***
HQ 960 GOSUB SUSPEND:GRAPHICS C2:POKE 559
   ,C0:POKE 709,14:POKE 711,C0:POKE 712,2
   18:POKE 710,212:GOSUB RESUME
HK 970 POKE 708,206:GOSUB 5410
VS 980 IF HOST THEN SIG=INT(C2*RND(C0)):G
   OSUB SIGNAL:GOTO 1010
GI 990 IF HOST=C0 THEN STATUS #MOD,X:IF P
   EEK(MSTAT) THEN GET #MOD,SIG:DL=C1:GOS
   UB CKSIG:DL=C0:SIG=C1-SIG:GOTO 1010
UG 1000 GOTO 990
MZ 1010 HOST=SIG:TURN=HOST
OY 1020 GOTO 5100
RU 1030 REM *** DIAL ***
GD 1040 LINE=DIAL:TRAP ERROR:GOSUB TERM:I
   F MDM<>C2 THEN STATUS #MOD,MDM
IS 1050 MSTAT=747:IF DEV$="T:" THEN MSTAT
   =1024
IP 1060 IF MDM>C127 THEN MDM=C1
FK 1070 ? "{CLR}":POKE C752,C1:? :POKE 559,C3
   2+C2:POKE 709,30
TC 1080 DL=PEEK(560)+PEEK(561)*C256+C6
OQ 1090 POKE DL,C6:POKE DL+C1,C6:POSITION
    C6,C1:? #C6;"directory"
AM 1100 GOSUB SUSPEND
BI 1110 POKE 195,C0:TRAP 1160:T3=C0:I=C0:
   CLOSE #C2:OPEN #C2,C4,C0,"D:DIAL.CHS"
WC 1120 POKE 703,24:POKE 195,C0:TRAP 1160
   :T3=T3+C1:POSITION C9+C9,C2:? "Page ";
   T3;"  "
IR 1130 POSITION C2,C5:TEMP$="":D=C0:FOR
   I=C0 TO C9
QJ 1140 NOTE #C2,A,B:INPUT #C2;S$:IF LEN(
   S$)<35 THEN D=C1:GOTO 1140
HN 1150 SE(I)=A:BY(I)=B:? I;". ";S$(C1,34
   ):NEXT I
BT 1160 POP :IF PEEK(195)=136 AND I=C0 AN
   D D=C0 THEN 1100
GV 1170 TRAP ERROR:D=I-C1
VI 1180 POKE 703,C4:? "{CLR}Type: ";:IF D=C0
   THEN ? "0, ";
LO 1190 IF D>C0 THEN ? "0-";CHR$(D+176);"
   , ";
WJ 1200 ? "Manual, Answer, Originate,"
FK 1210 ? "       Next page, Increase, Edi
   t"
OI 1220 S$="":GOSUB FIX:POKE 702,64:POKE
   694,C0:GET #KEY,X:HOST=C1
ZH 1230 ? "{CLR}":IF X>47 AND X<58 THEN 1320
LQ 1240 IF X<ASC("A") OR X>ASC("O") THEN
   1180
GY 1250 IF X=ASC("N") THEN POKE 703,24:PO
   SITION C0,C5:? D$:GOTO 1120
JU 1260 CLOSE #C2:IF X=ASC("I") THEN 1820
RR 1270 IF X=ASC("E") THEN 1980
DP 1280 IF X=ASC("O") THEN HOST=C1:GOTO 1
   600
TX 1290 IF X=ASC("A") THEN HOST=C0:GOTO 1
   600
HI 1300 IF X=ASC("M") THEN GOSUB RESUME:G
   OTO 1380
QJ 1310 GOTO 1160
NF 1320 X=X-C48:IF X>D THEN GOTO DIAL
AZ 1330 GOSUB SUSPEND
WQ 1340 CLOSE #C2:OPEN #C2,C4,C0,"D:DIAL.
   CHS"
CC 1350 POINT #C2,SE(X),BY(X):INPUT #C2;S
   $:? "{CLR}  You have selected: ";S$(C1,C6*
   C3);
VV 1360 S$=S$(21):CLOSE #C2:GOSUB RESUME:
   GOTO 1410
CV 1370 REM *** MANUAL ***
ZR 1380 POKE C752,C0:? "{CLR}  Number to dial
   ";:POKE C764,C255:INPUT S$:IF LEN(S$)=
   C0 THEN POKE C752,C1:GOTO DIAL
JR 1390 ? "{CLR} ";:IF LEN(S$)<C7 THEN 1380
RV 1400 REM *** DIALING ***
BI 1410 CLOSE #MOD:OPEN #MOD,13,C0,DEV$
OL 1420 POKE C752,C1:? "            Dialin
   g: ";
NM 1430 IF PEEK(746)=65 THEN 1430
NT 1440 IF MDM<C2 THEN XIO C32+C2,#MOD,C1
   28,C0,DEV$
WV 1450 CLOSE #MOD:OPEN #MOD,13,C0,DEV$:I
   F MDM=C2 THEN POKE C7,C1:? #MOD;"{ESC}N";:
   POKE C7,C0
UJ 1460 IF MDM=C1 THEN 1680
ZJ 1470 IF MDM=C2 THEN POKE C7,C1:? #MOD;
   "{ESC}K";
TO 1480 FOR I=C1 TO LEN(S$):X=ASC(S$(I,I)
   ):? S$(I,I);:IF X<C48 OR X>57 THEN 151
   0
DI 1490 IF MDM=C0 THEN XIO 75,#MOD,X,C0,D
   EV$
EJ 1500 IF MDM=C2 THEN ? #MOD;CHR$(X);
NR 1510 NEXT I:? :? "              Waiting.
   "
RV 1520 IF MDM=C2 THEN POKE C7,C0:GOSUB T
   ERM
ZG 1530 FOR I=C1 TO 36:STATUS #MOD,X:IF M
   DM=C0 AND PEEK(746)>C127 THEN 1580
XZ 1540 IF MDM=C2 AND PEEK(747)>C127 THEN
    POP :GOSUB RESUME:GOTO 1580
TJ 1550 IF PEEK(CONSOL)=C5 AND MDM=C0 THE
   N POP :XIO 77,#MOD,C0,C0,DEV$:GOTO DIA
   L
SW 1560 IF PEEK(CONSOL)=C5 AND MDM=C2 THE
   N POP :POKE C7,C0:? #MOD;"{ESC}M";:POKE C7
   ,C1:GOTO DIAL
KJ 1570 GOSUB PAUSE:NEXT I:GOSUB SUSPEND:
   GOTO DIAL
TN 1580 POP :GOSUB PAUSE:GOTO 820
DQ 1590 REM *** 835 ANS. ***
TB 1600 POKE C752,C1:? "{CLR}          Waiting
    for carrier."
AW 1610 ON MDM GOTO 1730,1770
EV 1620 GOSUB SUSPEND:GOSUB RESUME:XIO 76
   ,#MOD,C0,C0,DEV$
IX 1630 XIO 74,#MOD,C0,C0,DEV$
PZ 1640 GOSUB PAUSE:GOSUB TERM
MG 1650 STATUS #MOD,X:IF PEEK(746)<C128 T
```

```
   HEN 1610
RT 1660 GOTO 820
EY 1670 REM *** MPP DIAL ***
PD 1680 ? 5$:CLOSE #MOD:GOSUB PAUSE:OPEN
   #MOD,13,C0,DEV$
PJ 1690 ? #MOD;"ATD";5$;CHR$(13);:GOSUB T
   ERM
Q5 1700 STATUS #MOD,X:IF X=139 THEN GOTO
   DIAL
FC 1710 GOSUB TERM:GOSUB CLRBUF:GOTO 820
VQ 1720 REM *** MPP ANS. ***
OH 1730 CLOSE #MOD:OPEN #MOD,13,C0,DEV$:G
   OSUB PAUSE:? #MOD;"ATA";CHR$(13)
AO 1740 GOSUB TERM:STATUS #MOD,X:IF X=139
    THEN GOTO DIAL
MD 1750 GOSUB CLRBUF:GOTO 820
RW 1760 REM *** 1030 ANS. ***
GB 1770 CLOSE #C2:GOSUB RESUME
VI 1780 POKE C7,C1:? #MOD;"£L£J";:POKE C7
   ,C0
XZ 1790 FOR I=C1 TO 45:STATUS #MOD,X:IF P
   EEK(747)>C127 THEN TRAP ERROR:POP :GOT
   O 1710
AF 1800 GOSUB PAUSE:NEXT I:POKE C7,C1:? #
   MOD;"£M";:POKE C7,C0:GOTO DIAL
WF 1810 REM *** ADD NEW NUMBERS ***
NM 1820 TRAP 1830:CLOSE #C2:OPEN #C2,C9,C
   0,"D:DIAL.CHS":TRAP ERROR:GOTO 1840
SE 1830 TRAP LINE:CLOSE #C2:OPEN #C2,C8,C
   0,"D:DIAL.CHS":GOTO 1820
PV 1840 T3=C0:POKE C764,C255
DM 1850 POKE 752,C0
HD 1860 TEMP$=" ":TEMP$(C8*C5)=TEMP$:TEMP
   $(C2)=TEMP$
BL 1870 ? "£Name --------->";:INPUT 5$
GD 1880 IF LEN(5$)=C0 THEN 1960
OD 1890 IF LEN(5$)>C5*C4 THEN 5$(C7*C3)="
   "
CR 1900 TEMP$=5$
AM 1910 ? "Phone number ->";:POKE C764,C2
   55:INPUT 5$
ME 1920 TEMP$(C7*C3)=5$
KP 1930 TEMP$(36)=CHR$(C155)
UP 1940 IF T3 THEN RETURN
YH 1950 ? #C2;TEMP$
RI 1960 CLOSE #C2:GOTO DIAL
JW 1970 REM *** EDIT LIST ***
UC 1980 ? "£    Type number or RETURN to a
   bort."
ZM 1990 GOSUB FIX:POKE C764,C255:GET #KEY
   ,X:IF X=C155 THEN GOTO DIAL
MJ 2000 X=X-C48:IF X<C0 OR X>C9 THEN 1980
VX 2010 IF X>D THEN 1990
YE 2020 CLOSE #C2:OPEN #C2,C9+C3,C0,"D:DI
   AL.CHS"
MD 2030 POINT #C2,5E(X),BY(X):INPUT #C2;T
   EMP$
OH 2040 T3=C1:GOSUB 1860:T3=C0
IR 2050 POINT #C2,5E(X),BY(X)
CQ 2060 ? #C2;TEMP$:CLOSE #C2:GOTO DIAL
YT 2070 REM *** MAIN ***
HN 2080 LINE=MAIN:TRAP ERROR
JM 2090 GOSUB 4310:POKE 77,C0:GOSUB 3170:
   BUTTON=C0:A=TURN+C1:ON A GOTO 2110,236
   0
MU 2100 TURN=C0:GOTO MAIN
VH 2110 POKE 53248,C0
OZ 2120 REM *** NOT TURN ***
ZP 2130 GOSUB 280
KI 2140 IF 5IG=224 THEN 5ET=C0:GOSUB 4050
   :GOTO MAIN
UK 2150 IF 5ET THEN 2130
IE 2160 IF 5IG=251 THEN 2250
JP 2170 IF 5IG=C155-C1 THEN GOSUB 4330:GO
   TO 2130
GV 2180 IF 5IG=133 THEN GOSUB RECEIVE:A=A
   5C(5$(C1)):B=A5C(5$(C2)):POSITION A,B:
   ? #C6;" ":GOTO 2130
QO 2190 IF 5IG=C128 THEN GOSUB 2230:A=TUR
   N:GOSUB D5PMOV:TURN=A
RJ 2200 IF PEEK(CON5OL)=C3 THEN GOSUB OPT
   ION5:IF GIT THEN GOSUB CK5IG:GOTO 2140
5T 2210 IF PEEK(CON5OL)=C5 THEN GOSUB NOC
   LICK:GOSUB 5ETUP:IF OOP5 THEN GOSUB CK
   5IG:GOTO 2140
PJ 2220 GOTO 2130
LB 2230 GOSUB RECEIVE:FX=A5C(5$(C1)):FY=A
   5C(5$(C2)):TX=A5C(5$(C3)):TY=A5C(5$(C4
   )):RETURN
5I 2240 REM *** GET MOVE ***
AF 2250 GOSUB 2230
HW 2260 IF TY=C8 THEN GOSUB 3080
OJ 2270 CX=(FX+C6)*C8:CY=(FY+C2)*C8:GOSUB
    NOCLICK
MK 2280 GOSUB D5PMOV:GOSUB 3170:POKE C764
   ,C255
IT 2290 GOSUB 4290:5AVMOV=C1:GOSUB 3870:D
   ELETE$=5$
FN 2300 FOR I=C1 TO C9:POSITION TX,TY:? #
   C6;" ":GOSUB 2330:POSITION TX,TY:? #C6
   ;CHR$(CHAR):GOSUB 2330
ZY 2310 GOSUB CKIN:IF IN OR PEEK(C764)<C2
   55 THEN POP :GOTO MAIN
FW 2320 NEXT I:GOTO MAIN
FA 2330 FOR W=C1 TO 20:IF 5TICK(C0)<>15 O
   R 5TRIG(C0)=C0 THEN POP :POP :POP :POS
   ITION TX,TY:? #C6;CHR$(CHAR):GOTO MAIN
MO 2340 NEXT W:RETURN
HZ 2350 REM *** MY TURN ***
AC 2360 GOSUB 280
5D 2370 IF 5IG=C155-C1 THEN GOSUB 4330:GO
   TO 2360
KY 2380 IF 5IG=224 THEN 5ET=C0:GOSUB 4050
   :GOTO MAIN
YU 2390 IF 5ET THEN 2360
ZK 2400 IF 5TRIG(C0)=C0 THEN 2590
JL 2410 IF PEEK(CON5OL)=C5 THEN GOSUB 5ET
   UP:IF OOP5 THEN GOSUB CK5IG:GOTO 2370
GC 2420 IF PEEK(CON5OL)=C3 THEN GOSUB OPT
   ION5:IF GIT THEN GOSUB CK5IG:GOTO 2370
FQ 2430 GOSUB MOVCR5
5E 2440 GOTO 2360
FQ 2450 REM *** MOVE CURSOR ***
IR 2460 X=5TICK(C0):IF X=C9+C6 THEN RETUR
   N
OU 2470 CY=CY+C8*((X=C9+C4)+(X=C9)+(X=C5)
   -(X=C9+C1)-(X=C9+C5)-(X=C6))
N5 2480 CX=CX+C8*((X=C6)+(X=C7)+(X=C5)-(X
   =C9+C1)-(X=C9+C2)-(X=C9))
AK 2490 IF CX<96 THEN CX=152
JQ 2500 IF CX>152 THEN CX=96
CA 2510 IF CY<24 THEN CY=80
CD 2520 IF CY>80 THEN CY=24
HC 2530 A=511:POKE 53248,C0:X=U5R(ADR(MOV
   E$),OLDCY+PMBA5E+A,CY+PMBA5E+A,C9):POK
   E 53248,CX
WB 2540 OLDCY=CY:OLDCX=CX
IJ 2550 IF OFF=C0 THEN GOSUB 5U5PEND:5OUN
   D C3,C0,C0,13:5OUND C3,C0,C0,C0:GOTO R
   E5UME
WX 2560 OFF=C0:RETURN
KE 2570 OFF=C1:GOTO 2490
5E 2580 REM *** RECORD MY MOVE ***
EC 2590 GOSUB 5OUND
DY 2600 IF BUTTON THEN 2650
HM 2610 FX=CX/C8-C6:FY=CY/C8-C2:GOSUB LOC
   ATE1:X=CHAR
5Q 2620 IF HO5T=C0 AND X<C128 THEN 2360
XQ 2630 IF HO5T AND (X>C127 OR X=C32) THE
   N 2360
CO 2640 A=639:X=U5R(ADR(MOVE$),OY+PMBA5E+
   A,CY+PMBA5E+A,C9):OY=CY:POKE 53249,CX
UH 2650 IF BUTTON=C0 THEN 2720
UV 2660 TX=CX/C8-C6:TY=CY/C8-C2
RD 2670 IF FX=TX AND FY=TY THEN 2700
5W 2680 LX=TX:LY=TY:GOSUB LOCATE2:X=CHAR:
```

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CIRCLE #182 ON READER SERVICE CARD

```
   IF HOST AND X<C128 AND X<>C32 THEN 236
   0
UD 2690 IF HOST=C0 AND X>C127 THEN 2360
DA 2700 GOSUB 2830
DS 2710 GOSUB 2750
GX 2720 BUTTON=BUTTON+C1:IF BUTTON>C1 THE
   N 4100
SH 2730 GOTO 2360
IR 2740 REM *** EN PASSANT ***
QE 2750 IF FY<>C4 THEN RETURN
ZW 2760 LX=TX:LY=TY:GOSUB LOCATE2:IF CHAR
   <>C32 THEN RETURN
LZ 2770 IF ABS(TX-FX)<>C1 THEN RETURN
YE 2780 GOSUB LOCATE1:X=CHAR:IF X<>ASC(CH
   ARW$(C1,C1)) AND X<>ASC(CHARB$(C1,C1))
    THEN RETURN
QI 2790 POSITION TX,TY+C1:? #C6;" ":SIG=1
   33:GOSUB SIGNAL
BI 2800 A=TX-C5:A=TX(A):B=TY(TY+C1)
FW 2810 S$=CHR$(A):S$(C2)=CHR$(B):GOSUB S
   END:RETURN
CF 2820 REM *** CASTLE ***
EF 2830 X=ABS(FX-TX):IF X<>C2 THEN RETURN
SO 2840 IF FY<>TY THEN RETURN
PY 2850 IF FY<>C1 AND FY<>C8 THEN RETURN
JE 2860 GOSUB LOCATE1:IF CHAR<>ASC(CHARW$
   (C6,C6)) AND CHAR<>ASC(CHARB$(C6,C6))
   THEN RETURN
TD 2870 IF TX<FX THEN 2980
IE 2880 REM *** RIGHT ***
XI 2890 FOR I=FX+C1 TO TX+(HOST=C0):LX=I:
   LY=FY:GOSUB LOCATE2:IF CHAR<>C32 THEN
   POP :GOTO 2960
FI 2900 NEXT I
LA 2910 LX=TX+C1+(HOST=C0)
CY 2920 LY=TY:GOSUB LOCATE2:IF CHAR<>ASC(
   CHARW$(C2,C2)) AND CHAR<>ASC(CHARB$(C2
   ,C2)) THEN 2960
NU 2930 F1=FX:T1=TX:T3=TURN
YD 2940 FX=TX+C1+(HOST=C0):TX=TX-C1:GOSUB
    DSPMOV
QS 2950 GOTO 3040
VK 2960 BUTTON=C0:RETURN
XP 2970 REM *** LEFT ***
PT 2980 FOR I=TX TO FX-C1 STEP -C1:LX=I:L
   Y=FY:GOSUB LOCATE2:A=CHAR:IF A<>C32 TH
   EN POP :GOTO 2960
GJ 2990 NEXT I
TN 3000 LX=TX-C1-(HOST=C1):LY=TY:GOSUB LO
   CATE2:X=CHAR
DN 3010 IF X<>ASC(CHARW$(C2,C2)) AND X<>A
   SC(CHARB$(C2,C2)) THEN 2960
NA 3020 F1=FX:T1=TX:T3=TURN
XV 3030 FX=TX-C1-(HOST=C1):TX=TX+C1:GOSUB
    DSPMOV
DL 3040 SIG=C128:GOSUB SIGNAL
EQ 3050 GOSUB 3590:GOSUB SEND
HM 3060 FX=F1:TX=T1:TURN=T3:RETURN
TM 3070 REM *** PAWN2QUEEN ***
KA 3080 GOSUB LOCATE1:X=CHAR:IF X=ASC(CHA
   RW$(C1,C1)) THEN POSITION FX,FY:? #C6;
   CHARW$(C5,C5)
DP 3090 IF X=ASC(CHARB$(C1,C1)) THEN POSI
   TION FX,FY:? #C6;CHARB$(C5,C5)
AD 3100 RETURN
ZN 3110 REM *** DISPLAY MOVE ***
PM 3120 GOSUB LOCATE1:X=CHAR:POSITION FX,
   FY:? #C6;" ":COLOR X:PLOT TX,TY
RU 3130 TURN=C1-TURN:RETURN
QY 3140 REM *** PAUSE ***
AZ 3150 FOR W=C1 TO 40:NEXT W:RETURN
HA 3160 REM *** WHO'S TURN ***
HV 3170 GOSUB SUSPEND:TEMP$="
           "
KL 3180 IF TURN=C0 THEN 3220
OE 3190 A=INT((C5*C4-(LEN(N1$)+C7))/C2):T
   EMP$(A+C1)=N1$:TEMP$(LEN(TEMP$)+C1)="'
   5 "
SE 3200 X=LEN(N1$)/C2:IF X=INT(X) THEN X=
   C0
QR 3210 GOTO 3240
QJ 3220 A=INT((C5*C4-(LEN(N2$)+C7))/C2):T
   EMP$(A+C1)=N2$:TEMP$(LEN(TEMP$)+C1)="'
   5 "
TA 3230 X=LEN(N2$)/C2:IF X=INT(X) THEN X=
   C0
PJ 3240 IF X=C0 THEN TEMP$(LEN(TEMP$)+C1)
   =" "
UN 3250 TEMP$(LEN(TEMP$)+C1)="MOVE":TEMP$
   (21)="":POSITION C0,C0:? #C6;TEMP$
FY 3260 IF HOST AND TURN THEN POKE 708,14
AC 3270 IF HOST AND  NOT TURN THEN POKE 7
   08,C0
IR 3280 IF  NOT HOST AND TURN THEN POKE 7
   08,C0
QO 3290 IF  NOT HOST AND  NOT TURN THEN P
   OKE 708,14
EV 3300 GOTO RESUME
CZ 3310 REM *** SETUP ***
VR 3320 OOPS=C0:GOSUB TMP:TEMP$(C4)="Are
   you sure you want SETUP (Y/N)?"
KD 3330 GOSUB PRTMP:POKE C764,C255:GOSUB
   FIX
SB 3340 GOSUB CKIN:IF IN THEN 3370
CL 3350 IF PEEK(C764)<C255 THEN 3390
RU 3360 GOTO 3340
TR 3370 GET #MOD,SIG:IF SIG=C128 OR SIG=1
   33 OR SIG=C155-C1 OR SIG=224 OR SIG=25
   1 THEN OOPS=C1:GOTO 4310
SA 3380 GOTO 3340
RV 3390 GOSUB SUSPEND:GET #KEY,C
NH 3400 IF C<>ASC("Y") AND C<>ASC("y") TH
   EN GOTO MAIN
SJ 3410 BUTTON=C0:POKE 53249,C0:GOSUB NOC
   LICK
DP 3420 GOSUB 4330:SIG=C155-C1:GOSUB SIGN
   AL
YE 3430 IF STICK(C0)<>C9+C6 THEN 3480
ZF 3440 LX=CX/C8-C6:LY=CY/C8-C2:GOSUB LOC
   ATE2
LH 3450 FOR I=C1 TO LEN(CHAR$):IF CHR$(CH
   AR)=CHAR$(I,I) THEN A=I
FR 3460 NEXT I
NG 3470 IF PEEK(CONSOL)<>C7 THEN 3470
IZ 3480 GOSUB 280:IF STICK(C0)<>C9+C6 THE
   N GOSUB MOVCRS:GOTO 3430
IV 3490 IF PEEK(CONSOL)=C5 THEN 3540
MA 3500 IF STRIG(C0) THEN 3480
PG 3510 FX=CX/C8-C6:FY=CY/C8-C2:A=A+C1:GO
   SUB SOUND:POSITION FX,FY
AY 3520 TRAP 3530:? #C6;CHAR$(A,A):TRAP E
   RROR:FOR W=C1 TO C4:NEXT W:GOTO 3480
GA 3530 A=C1:GOTO 3520
GF 3540 IF TURN=C0 THEN POKE 53248,C0
BL 3550 GOSUB TMP:TEMP$(C9+C5)="Sending S
   ETUP.":GOSUB PRTMP
CM 3560 S$(C155+C5)="♥":X=USR(ADPEEK,ADR(S
   $))
XY 3570 S$(LEN(S$)+C1)=CHR$(TURN):S$(LEN(
   S$)+C1)=CHR$(HOST):DELETE$=S$:SIG=224:
   GOSUB SIGNAL:GOSUB SEND:GOTO 4310
UN 3580 REM *** CONVERT ***
ID 3590 A=FX-C5:A=TX(A):B=TY(FY):C=TX-C5:
   C=TX(C):D=TY(TY)
NK 3600 REM *** S$ A,B,C,D ***
LW 3610 S$=CHR$(A):S$(C2)=CHR$(B):S$(C3)=
   CHR$(C):S$(C4)=CHR$(D):RETURN
KH 3620 REM *** CRSCLR ***
GD 3630 POKE 704,206:POKE 705,206:IF HOST
    THEN POKE 704,C0:POKE 705,C0
AZ 3640 RETURN
ZS 3650 REM *** OPTIONS ***
PF 3660 TEMP$=" Return  End  Save  Load
   Take back move"
HV 3670 GOSUB PRTMP:POKE C764,C255
QH 3680 GOSUB CKIN:IF IN THEN 3710
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AN 3690 IF PEEK(C764)<C255 THEN 3730
UU 3700 GOTO 3680
RS 3710 GET #MOD,X:GIT=C0:IF X=C128 OR X=
   133 OR X=C155-C1 OR X=224 OR X=251 THE
   N SIG=X:GIT=C1:GOTO 4310
VA 3720 GOTO 3680
QR 3730 GOSUB FIX:GET #KEY,C:IF C=C155 OR
    C=ASC("R") OR C=ASC("r") THEN 4310
BM 3740 GOSUB SUSPEND
VC 3750 IF C=ASC("E") OR C=ASC("e") THEN
   3930
UA 3760 IF C=ASC("S") OR C=ASC("s") THEN
   3840
KW 3770 IF C=ASC("L") OR C=ASC("l") THEN
   3950
RH 3780 IF C=ASC("T") OR C=ASC("t") THEN
   3810
JT 3790 GOSUB RESUME:GOTO OPTIONS
YC 3800 REM *** DELETE MOVE ***
PV 3810 IF TURN<>C0 THEN ? "Y You may only
    take back a move if you  have just ma
   de a move.":GOSUB 4310:GOTO RESUME
QP 3820 S$=DELETE$:POP :GOTO 3990
MB 3830 REM *** SAVE GAME ***
VA 3840 GOSUB 4290:GOSUB 4270
MK 3850 POKE C764,C255:GOSUB FIX:GET #KEY
   ,C:IF C<>C155 THEN 3910
SS 3860 GOSUB SUSPEND:CLOSE #C2:OPEN #C2,
   C8,C0,"D:DATA.CHS"
CV 3870 S$(C155+C5)="♥":X=USR(QPEEK,ADR(S
   $))
RX 3880 S$(C155+C6)=CHR$(TURN):S$(C155+C7
   )=CHR$(HOST)
SC 3890 IF SAVMOV=C1 THEN SAVMOV=C0:RETUR
   N
PB 3900 ? #C2;S$:CLOSE #C2
UX 3910 GOSUB 4310:GOTO RESUME
RQ 3920 REM *** END GAME ***
KO 3930 POP :GOSUB 4520:GOSUB RESUME:GOTO
    870
CZ 3940 REM *** LOAD GAME ***
DW 3950 GOSUB 4270
LD 3960 POKE C764,C255:GOSUB FIX:GET #KEY
   ,C:IF C<>C155 THEN GOSUB 4310:GOTO RES
   UME
CO 3970 POP :GOSUB TMP:TEMP$(14)="Loading
    game.":GOSUB PRTMP
PP 3980 CLOSE #C2:OPEN #C2,C4,C0,"D:DATA.
   CHS":INPUT #C2;S$:DELETE$=S$
GW 3990 TURN=ASC(S$(C155+C6)):HOST=ASC(S$
   (C155+C7))
SM 4000 GOSUB 3630:GOSUB NOCLICK:TEMP$=S$
   :S$=TEMP$(C1,C155+C5):GOSUB 4290:START
   =DL:GOSUB 5390:S$=TEMP$
ZA 4010 GOSUB RESUME
QZ 4020 GOSUB TMP:TEMP$(C9+C5)="Sending
    game.":GOSUB PRTMP
RB 4030 SIG=224:GOSUB SIGNAL:GOSUB SEND:G
   OTO MAIN
MD 4040 REM *** RECEIVE GAME ***
OX 4050 GOSUB TMP:TEMP$(C9+C4)="Receiving
    game.":GOSUB PRTMP:GOSUB RECEIVE:S$(
   LEN(S$)-C1)=""
IS 4060 TURN=ASC(S$(C155+C6)):TURN=C1-TUR
   N:HOST=ASC(S$(C155+C7)):HOST=C1-HOST:S
   $(C155+C6)="":TEMP$(C155+C5)="♥"
BS 4080 S$=TEMP$:GOSUB 4290:GOSUB 3630:GO
   SUB NOCLICK:START=DL:GOSUB 4310:GOTO 5
   390
FI 4090 REM *** SEND MOVE ***
VV 4100 POKE 53249,C0
KY 4110 IF FX=TX AND FY=TY THEN BUTTON=C0
   :GOTO 2360
DX 4120 IF TY=C1 THEN GOSUB 3080
FZ 4130 GOSUB DSPMOV
MW 4140 SIG=251:GOSUB SIGNAL
ET 4150 GOSUB 3590:GOSUB SEND
JU 4160 GOTO MAIN
EL 4170 REM *** LOCATE1 ***
LZ 4180 LX=FX:LY=FY
FL 4190 REM *** LOCATE2 ***
FD 4200 LOCATE LX,LY,CHAR:COLOR CHAR:PLOT
    LX,LY:RETURN
DX 4210 REM *** FIX ***
TG 4220 DUMMY$=STR$(C):RETURN
WR 4230 REM *** SOUND ***
JH 4240 GOSUB SUSPEND:SOUND C3,64,C9+C1,C
   8:FOR W=C1 TO C2:NEXT W:SOUND C3,C0,C0
   ,C0
FJ 4250 GOTO RESUME
ZU 4260 REM *** PROMPT ***
HQ 4270 GOSUB TMP:TEMP$(C4)="Insert data
   disk and press RETURN.":GOSUB PRTMP:RE
   TURN
DP 4280 REM *** SCREEN ***
IT 4290 DL=PEEK(88)+PEEK(89)*C256+20:RETU
   RN
LC 4300 REM *** CLR SET ***
XW 4310 SET=C0:POSITION C0,C9:? #C6;"  OP
   TION = MENU          SELECT = SETUP   "
   :RETURN
OS 4320 REM *** ? SET ***
XL 4330 GOSUB SOUND:GOSUB SOUND:GOSUB TMP
   :TEMP$(C9+C9)="SETUP!":GOSUB PRTMP:SET
   =C1:RETURN
AJ 4340 POKE C752,C1:POSITION C3,C9+C8:?
   " Unable to communicate with modem."
SQ 4350 GOTO 4350
JM 4360 REM *** TMP ***
BS 4370 TEMP$=CHR$(160):TEMP$(C8*C5)=TEMP
   $:TEMP$(C2)=TEMP$:RETURN
EM 4380 REM *** PRTMP ***
YU 4390 TEMP$(41)="":POSITION C0,C9:? #C6
   ;TEMP$:RETURN
HP 4400 REM *** INIT ***
PK 4410 LINE=4340:TRAP ERROR
IZ 4420 DIM CHARW$(7),CHARB$(6),N1$(10),N
   2$(10),MOVE$(44),MOD$(228),TX(8),TY(8)
   ,CHAR$(13),DUMMY$(15),S$(170)
WV 4430 DIM DEV$(2),TEMP$(170),SE(10),BY(
   10),D$(20),DELETE$(170)
LS 4440 RESTORE 5480:READ C0,C1,C2,C3,C4,
   C5,C6,C7,C8,C9,C32,C48,C126,C127,C128,
   C155,C255,C256,C752,C764
WC 4450 D$=CHR$(156):D$(20)=D$:D$(C2)=D$
JT 4470 KEY=C1:MOD=C4:OK=13:LET CLRBUF=74
   0:NOCLICK=2570:CKSIG=680
RU 4480 MOVCRS=2460:PAUSE=3150:MAIN=2080:
   DSPMOV=3120:SETUP=3320:SUSPEND=420:RES
   UME=470:SIGNAL=600
OG 4490 OPTIONS=3660:SEND=320:RECEIVE=50:
   LET LOCATE1=4180:LET LOCATE2=4200:FIX=
   4220:CKIN=250:TMP=4370:PRTMP=4390
XH 4500 LET SOUND=4240:TERM=530:CONSOL=53
   279:ERROR=5500:DIAL=1040
CW 4510 GOSUB 4520:GOTO 4530
WD 4520 FOR I=53248 TO 53251:POKE I,C0:NE
   XT I:POKE 82,C2:RETURN
FR 4530 X=PEEK(106)-(C8+C8):CHSET=(X+C4)*
   C256:POKE 54279,X+C8
WF 4540 POKE 106,X:POKE 82,C0:GRAPHICS C0
   :POKE C752,C1:? :POKE 710,196:POKE 712
   ,196:POKE 708,28:POKE 709,14
KH 4550 GOSUB 5420:POKE 559,C0
YY 4780 POKE 82,C2
BQ 4840 MOD$(72,72)=CHR$(C155)
YU 4850 REM *** GET NAMES ***
ND 4860 TRAP 4340:GOSUB 780:OPEN #KEY,C4,
   C0,"K:":CLOSE #MOD:OPEN #MOD,13,C0,DEV
   $:GOSUB SUSPEND
TG 4870 IF DEV$="R:" THEN XIO 36,#MOD,C0,
   C0,DEV$
RY 4880 TRAP ERROR:POKE C752,C0:TRAP 4880
   :POSITION C3,22:? "What is your first
   name";:POKE 559,C32+C2
WP 4890 INPUT N1$:IF LEN(N1$)=C0 THEN 488
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   0
HB 4900 FOR I=C1 TO LEN(N1$):X=ASC(N1$(I,
   I)):IF X>90 THEN N1$(I,I)=CHR$(X-C32)
FN 4910 NEXT I
HI 4920 POKE C752,C1:POSITION C0,22:? D$:
   POSITION C3,22:? CHR$(34);"How about a
    nice game of Chess?";CHR$(34)
JU 4930 LINE=4930:TRAP ERROR:RESTORE 5450
   :FOR I=C1 TO C8:READ X:TX(I)=X:NEXT I
LD 4940 FOR I=C1 TO C8:READ X:TY(I)=X:NEX
   T I
NC 4950 REM *** SET UP BOARD ***
UF 4960 X=PEEK(106)+C8:PMBASE=C256*X:POKE
    53277,C3
YH 4970 S$="33333333LLLLLLLL33333333LLLLL
   LLL33333333LLLLLLLL33333333LLLLLLLL"
UA 4980 START=768+PMBASE+24:GOSUB 5390:ST
   ART=START+C128:GOSUB 5390
QR 4990 CX=120:CY=C48:OLDCX=CX:OLDCY=CY:O
   Y=CY
OD 5000 START=PMBASE+512+CY
LG 5020 GOSUB 5390:A=640:FOR I=PMBASE+A+C
   Y TO PMBASE+A+CY+C7:POKE I,C255:NEXT I
   :POKE 559,C0
LX 5040 START=CHSET+ASC(CHARW$(C1))*C8
YM 5060 GOSUB 5390:START=CHSET+ASC(CHARW$
   (C5))*C8
ZQ 5080 GOSUB 5390:GOTO DIAL
JI 5090 REM *** PLAY ***
CJ 5100 DL=PEEK(560)+PEEK(561)*C256+14:PO
   KE DL,C2:GOSUB 4310
EC 5110 REM *** COLORS ETC. ***
YA 5120 POKE 706,214:POKE 707,214
CM 5130 GOSUB 3630
WM 5140 POKE 756,CHSET/C256
MW 5150 IF HOST=C1 THEN 5260
XL 5160 REM *** BLACK ***
MZ 5170 POSITION C6,C1
NY 5190 POSITION C6,C2
QT 5210 POSITION C6,C7
RS 5230 POSITION C6,C8
SH 5250 REM *** WHITE ***
MY 5260 POSITION C6,C1
NX 5280 POSITION C6,C2
QS 5300 POSITION C6,C7
RR 5320 POSITION C6,C8
TN 5340 POKE C752,C0:? "K       ↕↓ Convers
   ation  Window ↕↓"
IJ 5350 POKE 53258,C3:POKE 53259,C3
ZR 5360 POKE 623,C4:POKE 559,C48-C2:CX=12
   0:CY=C48:OFF=C1:GOSUB 2530:OFF=C0:IF H
   OST THEN GOSUB NOCLICK
WY 5370 POKE 53250,C48*C2:POKE 53251,C128
   :GOSUB 4290:SAVMOV=C1:GOSUB 3870:DELET
   E$=S$:GOTO MAIN
GJ 5380 REM *** KWIK POKE ***
AL 5400 RETURN
GQ 5410 GOSUB TERM
VO 5420 X=PEEK(16):IF X>127 THEN X=X-128:
   POKE 16,X:POKE 53774,X
AU 5430 RETURN
FN 5440 REM *** TX() TY() ***
BO 5450 DATA 13,12,11,10,9,8,7,6
WL 5460 DATA 8,7,6,5,4,3,2,1
VC 5470 REM *** VARIABLES ***
VE 5480 DATA 0,1,2,3,4,5,6,7,8,9,32,48,12
   6,127,128,155,255,256,752,764
AG 5490 REM *** ERROR ***
KS 5500 POP :POP :POP :POP :POP :POP
FS 5510 STATUS #MOD,X:IF MDM=C0 AND PEEK(
   746)<C128 THEN 5570
NJ 5520 IF MDM=C2 AND PEEK(747)<C128 THEN
    5570
MN 5530 X=PEEK(195)
LB 5540 IF X=130 OR (X>137 AND X<145) THE
   N ? "K":POSITION C9,C9+C3:? "Check you
   r disk drive or modem.":GOTO 5580
ZR 5550 IF X=170 THEN ? "K":POSITION C9+C
   5,C9+C3:? "Wrong disk.":GOTO 5580
LB 5560 GOTO LINE
P5 5570 ? "K":POSITION C9+C3,C9+C3:? "Ca
   rrier lost."
VP 5580 FOR I=C1 TO C5:GOSUB PAUSE:NEXT I
   :GOTO LINE
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Listing 2.
BASIC listing.

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PW 10 DIM OUT$(120):CLOSE #1:OPEN #1,8,0,
   "D:MDMCHESS.DAT":RESTORE :POKE 766,1
ZW 20 TRAP 50:READ LENGTH
AF 30 FOR I=1 TO LENGTH:READ A:OUT$(LEN(O
   UT$)+1)=CHR$(A):NEXT I
HO 40 ? #1;OUT$:? OUT$:OUT$="":GOTO 20
HN 50 IF PEEK(195)<>6 THEN ? "Error #";PE
   EK(195);" at line ";PEEK(186)+PEEK(187
   )*256:GOTO 70
HM 60 IF LEN(OUT$) THEN ? #1;OUT$:? OUT$
ES 70 CLOSE #1:POKE 766,0:END
YZ 80 DATA 65,55,53,48,32,88,61,85,83,82,
   40,65,68,82,40,34,216,104,169,0,133,20
   3,133,204,162,64,169,13,157
BJ 90 DATA 66,3,32,86,228,160,0,177,205,2
   40,22,162,64,169,7,157,66,3,169,0,157,
   72,3,157,73,3,32,86,228,160
JW 100 DATA 0,240,218,96,34,41,41
DB 110 DATA 79,52,48,55,48,32,88,61,85,83
   ,82,40,65,68,82,40,34,216,104,104,133,
   204,104,133,203,104,133,206,104
HN 120 DATA 133,205,160,0,132,207,169,159
   ,133,208,164,207,177,203,164,208,145,2
   05,198,208,230,207,164,207,192
MT 130 DATA 160,208,238,96,34,41,44,65,68
   ,82,40,83,36,41,44,65,68,82,40,84,69,7
   7,80,36,41,41
DC 140 DATA 57,52,52,54,48,32,81,80,69,69
   ,75,61,65,68,82,40,34,216,104,104,133,
   204,104,133,203,165,88,133,205
DN 150 DATA 165,89,133,206,165,205,24,105
   ,20,133,205,144,2,230,206,160,0,177,20
   5,145,203,200,192,160,208,247
UH 160 DATA 96,34,41
VD 170 DATA 57,52,53,54,48,32,88,61,85,83
   ,82,40,65,68,82,40,34,216,104,104,133,
   204,104,133,203,104,104,133,205
ZI 180 DATA 169,0,168,145,203,200,208,251
   ,230,204,198,205,166,205,208,243,96,34
   ,41,44,67,72,83,69,84,44,67,56,41
YG 190 DATA 51,52,53,55,48,32,63,32,34,28
   ,145,146,146,146,146,146,146,146,146,1
   46,146,146,146,146,146,146,146,146
HK 200 DATA 146,146,146,146,146,146,146,1
   46,146,146,146,146,146,146,146,146,146
   ,146,146,146,146,146,133,34,59
GY 210 DATA 50,52,53,56,48,32,63,32,34,25
   2,160,160,160,160,160,160,160,160,160,
   160,136,32,32,160,160,160,136
FR 220 DATA 32,32,8,160,160,160,160,160,1
   60,160,160,160,160,160,160,160,160,160
   ,160,160,160,252,34,59
PX 230 DATA 50,52,53,57,48,32,63,32,34,25
   2,160,160,160,160,160,160,160,160,160,
   136,32,8,32,160,136,8,136,14
DU 240 DATA 8,160,160,160,160,160,160,160
   ,160,160,160,160,160,160,160,160,160,1
   60,160,160,252,34,59
JO 250 DATA 50,52,54,48,48,32,63,32,34,25
   2,160,160,160,160,160,160,160,160,136,
   32,8,160,136,8,160,136,32,22
FL 260 DATA 32,2,32,32,138,22,32,32,22,13
   8,136,2,160,160,160,160,160,160,160,16
   0,252,34,59
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AM 270 DATA 50,52,54,49,48,32,63,32,34,25
   2,160,160,160,160,160,160,160,136,32,8
   ,160,160,160,160,136,32,8,22
DP 280 DATA 160,2,2,160,22,22,160,160,22,
   10,8,2,160,160,160,160,160,160,160,160
   ,252,34,59
TD 290 DATA 50,52,54,50,48,32,63,32,34,25
   2,160,160,160,160,160,160,136,32,8,160
   ,160,160,160,136,32,8,160,22
UH 300 DATA 160,2,2,160,22,22,21,160,22,1
   60,160,2,160,160,160,160,160,160,160,1
   60,252,34,59
SA 310 DATA 50,52,54,51,48,32,63,32,34,25
   2,160,160,160,160,160,136,32,8,160,160
   ,160,160,136,32,8,160,160,22
DL 320 DATA 32,2,32,32,8,22,32,32,22,160,
   160,2,160,160,160,160,160,160,160,160,
   252,34,59
AR 330 DATA 50,52,54,52,48,32,63,32,34,25
   2,160,160,160,160,160,160,160,160,160,
   160,160,160,160,160,160,160,160,160
HD 340 DATA 160,160,160,160,160,160,160,1
   60,160,160,160,160,160,160,160,160,160
   ,160,160,160,160,252,34,59
OB 350 DATA 50,52,54,53,48,32,63,32,34,25
   2,160,160,160,160,160,160,160,160,160,
   160,160,160,160,160,160,160,160,136
FM 360 DATA 32,32,32,32,32,32,8,160,160,1
   60,160,160,160,160,160,160,160,160,160
   ,160,160,252,34,59
QT 370 DATA 50,52,54,54,48,32,63,32,34,25
   2,160,160,160,160,160,160,160,160,160,
   160,160,160,160,160,160,160,136,32
IR 380 DATA 8,160,160,136,14,8,160,160,16
   0,160,160,160,160,160,160,160,160,160,
   160,160,160,252,34,59
VQ 390 DATA 50,52,54,55,48,32,63,32,34,25
   2,160,160,160,160,160,160,160,160,160,
   160,160,160,160,160,136,32,8
ME 400 DATA 160,160,136,32,22,160,32,22,3
   2,32,22,14,14,22,14,14,160,160,160,160
   ,160,252,34,59
VE 410 DATA 50,52,54,56,48,32,63,32,34,25
   2,160,160,160,160,160,160,160,160,160,
   160,160,160,160,160,136,32,8,160
DR 420 DATA 160,160,160,160,22,160,32,22,
   160,160,22,13,13,22,13,13,160,160,160,
   160,160,252,34,59
VL 430 DATA 50,52,54,57,48,32,63,32,34,25
   2,160,160,160,160,160,160,160,160,160,
   160,160,160,160,136,32,8,160,160
DJ 440 DATA 136,32,8,160,22,21,32,22,21,1
   60,160,160,32,160,160,32,160,160,160,1
   60,160,252,34,59
EC 450 DATA 50,52,55,48,48,32,63,32,34,25
   2,160,160,160,160,160,160,160,160,160,
   160,160,136,32,32,32,32,32,32
TY 460 DATA 8,160,160,22,160,32,22,32,32,
   22,32,32,22,32,32,160,160,160,160,160,
   252,34,59
LU 470 DATA 50,52,55,49,48,32,63,32,34,15
   4,146,146,146,146,146,146,146,146,151,
   146,146,146,146,146,146,146,146
XF 480 DATA 146,146,146,146,146,146,146,1
   46,146,146,146,146,151,146,146,146,146
   ,146,146,146,146,131,34,59
NY 490 DATA 40,52,55,50,48,32,63,32,34,32
   ,32,32,32,32,32,32,32,32,252,160,160,1
   60,160,160,160,160,160,160,160,160
AE 500 DATA 160,160,160,160,160,160,160,1
   60,160,160,252,34
SU 510 DATA 40,52,55,51,48,32,63,32,34,32
   ,32,32,32,32,32,32,32,32,252,160,195,2
   39,240,249,242,233,231,232,244
ZZ 520 DATA 160,168,227,169,160,177,185,1
   84,182,160,252,34
EE 530 DATA 40,52,55,52,48,32,63,32,34,32
   ,32,32,32,32,32,32,32,32,252,160,160,1
   60,226,249,160,160,199,225,242
KW 540 DATA 249,160,200,229,233,244,250,1
   60,160,160,252,34
PZ 550 DATA 40,52,55,53,48,32,63,32,34,32
   ,32,32,32,32,32,32,32,32,252,160,160,1
   60,160,160,160,160,160,160,160,160
AQ 560 DATA 160,160,160,160,160,160,160,1
   60,160,160,252,34
ZR 570 DATA 40,52,55,54,48,32,63,32,34,32
   ,32,32,32,32,32,32,32,32,154,146,146,1
   46,146,146,146,146,146,146,146,146
NW 580 DATA 146,146,146,146,146,146,146,1
   46,146,146,131,34
LT 590 DATA 36,52,55,55,48,32,67,72,65,82
   ,87,36,61,34,3,4,5,6,10,11,34,58,67,72
   ,65,82,66,36,61,34,131,132,133
XF 600 DATA 134,138,139,34
JK 610 DATA 26,52,55,57,48,32,67,72,65,82
   ,36,61,34,139,138,134,133,132,131,11,1
   0,6,5,4,3,32,34
JA 620 DATA 57,52,56,48,48,32,77,79,86,69
   ,36,61,34,104,104,133,204,104,133,203,
   104,133,206,104,133,205,104,104
AP 630 DATA 133,207,164,207,177,203,153,2
   53,3,169,0,145,203,136,208,244,160,0,1
   85,253,3,145,205,200,196,207
IP 640 DATA 208,246,96,34
JY 650 DATA 102,52,56,49,48,32,77,79,68,3
   6,61,34,216,104,169,0,133,203,133,204,
   162,64,169,13,157,66,3,32,86
CV 660 DATA 228,160,0,177,205,240,78,162,
   64,169,7,157,66,3,169,0,157,72,3,157,7
   3,3,32,86,228,201,128,240,103
PJ 670 DATA 201,133,240,99,201,154,240,95
   ,201,224,240,91,201,251,240,87,201,28,
   144,36,201,253,240,8,201,32,240
OV 680 DATA 4,201,127,176,24,162,0,168,16
   9,11,157,66,3,169,0,157,72,34
AQ 690 DATA 106,52,56,50,48,32,77,79,68,3
   6,40,57,49,41,61,34,3,157,73,3,152,32,
   86,228,208,158,240,156,173,252
HJ 700 DATA 2,201,255,240,92,162,16,169,7
   ,157,66,3,169,0,157,72,3,157,73,3,32,8
   6,228,201,128,240,70,201,133
CU 710 DATA 240,66,201,154,240,62,201,224
   ,240,58,201,251,240,54,208,4,208,69,24
   0,67,162,0,168,169,11,157,66
VA 720 DATA 3,169,0,157,72,3,157,73,3,152
   ,32,86,228,208,6,240,4,208,177,240,34
EC 730 DATA 64,52,56,51,48,32,77,79,68,36
   ,40,49,56,49,41,61,34,175,162,64,168,1
   69,11,157,66,3,169,0,157,72,3
DX 740 DATA 157,73,3,152,32,86,228,173,13
   2,2,240,14,173,120,2,201,15,208,7,173,
   31,208,201,7,16,213,133,212,169
MO 750 DATA 0,133,213,96,34
AF 760 DATA 18,53,48,49,48,32,83,36,61,34
   ,255,129,129,129,129,129,129,255,34
ZJ 770 DATA 67,53,48,51,48,32,88,61,85,83
   ,82,40,65,68,82,40,34,216,169,0,133,21
   2,104,104,133,204,104,133,203
PF 780 DATA 169,0,133,205,169,224,133,206
   ,160,0,177,205,145,203,200,208,249,230
   ,206,230,204,230,212,165,212
KD 790 DATA 201,4,208,237,96,34,41,44,67,
   72,83,69,84,41
UD 800 DATA 42,53,48,53,48,32,83,36,61,34
   ,0,24,60,60,24,60,126,0,0,90,126,60,60
   ,126,126,0,0,56,108,126,102,112
DS 810 DATA 120,0,0,24,52,110,60,24,126,0
   ,34
KD 820 DATA 26,53,48,55,48,32,83,36,61,34
   ,0,90,126,126,60,24,126,0,0,24,60,90,1
   26,60,126,0,34
RV 830 DATA 21,53,49,56,48,32,63,32,35,67
   ,54,59,34,4,5,6,11,10,6,5,4,34
EM 840 DATA 21,53,50,48,48,32,63,32,35,67
   ,54,59,34,3,3,3,3,3,3,3,3,34
```

Modem Chess *continued*

```
DT 850 DATA 21,53,50,50,48,32,63,32,35,67
   ,54,59,34,131,131,131,131,131,131,131,
   131,34
NQ 860 DATA 31,53,50,52,48,32,63,32,35,67
   ,54,59,34,132,133,134,139,138,134,133,
   132,34,58,71,79,84,79,32,53,51,52,48
XI 870 DATA 21,53,50,55,48,32,63,32,35,67
   ,54,59,34,132,133,134,138,139,134,133,
   132,34
JJ 880 DATA 21,53,50,57,48,32,63,32,35,67
   ,54,59,34,131,131,131,131,131,131,131,
   131,34
GH 890 DATA 21,53,51,49,48,32,63,32,35,67
   ,54,59,34,3,3,3,3,3,3,3,3,34
JH 900 DATA 21,53,51,51,48,32,63,32,35,67
   ,54,59,34,4,5,6,10,11,6,5,4,34
JT 910 DATA 108,53,51,57,48,32,88,61,85,8
   3,82,40,65,68,82,40,34,216,104,104,133
   ,204,104,133,203,104,133,206
ZC 920 DATA 104,133,205,104,133,208,104,1
   33,207,160,0,132,212,132,213,177,203,1
   45,207,230,212,165,212,208,2
HB 930 DATA 230,213,230,207,165,207,208,2
   ,230,208,230,203,165,203,208,2,230,204
   ,165,212,197,205,208,222,165
XZ 940 DATA 213,197,206,208,216,96,34,41,
   44,65,68,82,40,83,36,41,44,76,69,78,40
   ,83,36,41,44,83,84,65,82,84,41
```

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DLIs

continued from page 111

```
0630      LDX #$00
0640 FOUR LDA 40800,X
0650      STA 40120,X
0660      INX
0670      CPX #40
0680      BNE FOUR
0690      LDX #$00
0700 FIVE LDA 40760,X
0710      STA 40160,X
0720      INX
0730      CPX #40
0740      BNE FIVE
0750      LDX #$00
0760 SIXX LDA 40720,X
0770      STA 40200,X
0780      INX
0790      CPX #40
0800      BNE SIXX
0810      LDX #$00
0820 SEVN LDA 40680,X
0830      STA 40240,X
0840      INX
0850      CPX #40
0860      BNE SEVN
0870      LDX #$00
0880 EGHT LDA 40640,X
0890      STA 40280,X
0900      INX
0910      CPX #40
0920      BNE EGHT
0930      LDX #$00
0940 NINE LDA 40600,X
0950      STA 40320,X
0960      INX
0970      CPX #40
0980      BNE NINE
0990      LDX #$00
1000 TENN LDA 40560,X
1010      STA 40360,X
1020      INX
1030      CPX #40
1040      BNE TENN
1050      LDX #$00
1060 LEVN LDA 40520,X
1070      STA 40400,X
1080      INX
1090      CPX #40
1100      BNE LEVN
1110      LDX #$00
1120 TWLV LDA 40480,X
1130      STA 40440,X
1140      INX
1150      CPX #40
1160      BNE TWLV
1170      LDA #$00
1180      STA 512
1190      LDA #$40
1200      STA 513
1210      PLA
1220      TAY
1230      PLA
1240      TAX
1250      PLA
1260      RTI
1270 ; Here, the registers are placed
1280 ;onto the stack, and the colors
1290 ;and flip value are chosen and
1300 ;Stored.  "A" Loads the cursor
1310 ;row, and if it is #$B, it is
1320 ;changed to #$0 and moved up a
1330 ;row.  If the cursor row is not
1340 ;#$B or #$0, one row above or
1350 ;below the unmirrored portion
1360 ;of the screen, nothing happens
1370 ;at all.  If it is #$0, it is
1380 ;turned into #$B and moved
1390 ;downward.  The next DLI is
1400 ;made to be the one at $0600,
1410 ;and the registers are regained
1420 ;for a final departure.
1430      *=  $4000
1440      PHA
1450      TXA
1460      PHA
1470      TYA
1480      PHA
1490      LDA #$FF
1500      STA $D40A
1510      LDX #$80
1520      LDY #$06
1530      STA $D017
1540      STX $D018
1550      STY $D401
1560      LDA $54
1570      CMP #$0B
1580      BEQ TRTN
1590      CMP #$00
1600      BNE FRTN
1610      LDA #$0B
1620      STA $54
1630      LDA #'↓
1640      JSR $F6A4
1650      JMP FRTN
1660 TRTN LDA #$00
1670      STA $54
1680      LDA #'↑
1690      JSR $F6A4
1700 FRTN LDA #$00
1710      STA 512
1720      LDA #$06
1730      STA 513
1740      PLA
1750      TAY
1760      PLA
1770      TAX
1780      PLA
1790      RTI
1800 ; This is the true program:  It
1810 ;Stores #$F0 and #130 in bytes
1820 ;2 and 16 of the display list.
1830 ;The first DLI is selected
1840 ;($0600) and NMIEN is secured.
1850      *=  $6000
1860      LDA 560
1870      STA 203
1880      LDA 561
1890      STA 204
1900      LDA #$F0
1910      LDY #$02
1920      STA (203),Y
1930      LDA #130
1940      LDY #16
1950      STA (203),Y
1960      LDA #$00
1970      STA 512
1980      LDA #$06
1990      STA 513
2000      LDA #$C0
2010      STA 54286
2020 END
```

●

Panak strikes!

(continued from page 188)

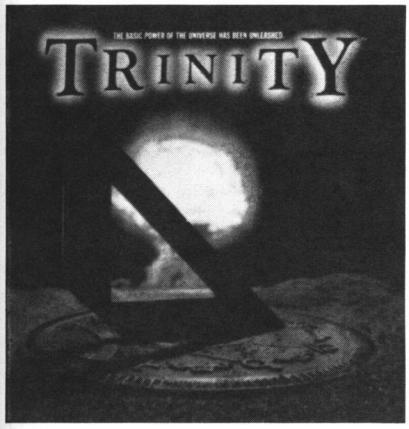
There are enough words in each category to keep it interesting for quite a few plays. The introductory package contains 200 cards. If the game is a success, I'm sure more will be issued. And the game will be a success—if enough people talk about it. **Buzzword** is a fun game, and a good vocabulary-building tool.

Well, I finally did it—took the plunge and got a 520ST. While I'd like to tell you about the machine, I've very little space left. This is partly due to the backlog of ST games I have to test, but mostly because of this particular game. If it's any indication of things to come, I won't be having much free time in the months ahead.

Trinity

by Brian Moriarty
INFOCOM, INC.
125 CambridgePark Drive
Cambridge, MA 02140
ST $39.95

I've been waiting quite a while for this one. Since the first Interactive Plus game from the wizards at Infocom gave me a taste of really large universes (larger than a mere 48K) I've waited for a second serving. It has come not a moment too soon, a double helping of gourmet food for my starving mind.



Trinity.

This taste treat is **Trinity**, the newest work of interactive fiction from Brian Moriarty, the twisted genius who gave us the **Wishbringer** stone. His new masterpiece is as serious as it is challenging.

The scenario is an uneasy one. Amid superpower tension, you decide to take a much-needed vacation and visit jolly old London. Unfortunately for you (as well as your travel agent and the rest of the world's population), the last day of your vacation is also the first (and perhaps only) day of World War III. Not to worry; with interactive fiction, anything is possible. If you should be fortunate enough to survive the first series of puzzles, you'll be treated to another twenty-odd hours of time-travel fantasy.

Trinity takes its name from the U.S. government's experiment of the same name—the test of the first atomic bomb. This standard-level game has over 600 objects and locations to explore, and boasts a vocabulary of over 2000 words. This vastness might be for naught if the prose were not vivid enough. Fortunately, it is.

Visits by the author to the actual locations yield descriptions so real you can almost reach out and touch them. You'll enjoy your travels, from London's Kensington Gardens to the magical world through the white door, and beyond.

While standing on the summit, "as your eyes sweep the landscape, you notice more of the giant toadstools. There must be hundreds of them. Some sprout in clusters, others grow in solitude among the trees. Their numbers increase dramatically as your gaze moves westward, until the forest is choked with pale domes." Even if you didn't know how important the toadstools would be, you'd still want to "Go west, young man." The toadstools are the key, doorways to time travel which drop you in and out of history's major nuclear explosions. The goal: save the world.

Characters populating the world are intriguing. From the giant boy, to the old crone selling birdseed in the gardens, all the inhabitants of **Trinity's** strange lands surprise, confound and entertain you. Puzzles are prevalent, tough enough to keep even the experienced adventurer on his toes. Regular Infocomers will recognize a couple of unique features. These include holding off the title page until you survive the first tricky teaser, as well as interspersed quotes from other classic works of fiction, which add to the drama and quality of our experience. And, while this is a serious theme, tackling a serious topic, there's more than enough of the Infocom lightheartedness to go around.

The superb documentation contains a paper sundial, a map of the **Trinity** site and directions for folding an origami crane—all of which are integral parts of the story. The instruction booklet is packaged with a comic book entitled *The Illustrated History of the Atom Bomb*. Reading this is almost as entertaining as playing the game itself. As usual, the manual more than adequately explains how to play, without giving away any secrets.

Considering all of this, I can say that they've done it again—bigger and better than before. If you have an ST and haven't played an Infocom game, this one is a must. Like all of their works, **Trinity** lives up to your lofty expectations, then surpasses them. Above all, despite its serious overtones, **Trinity** is a blast.

The author wishes to express his appreciation to The Magic One Computer Shop of Barberton, Ohio for their constant support in the creation of this chronicle.

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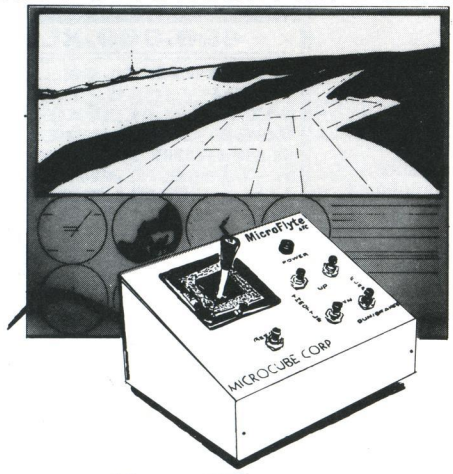

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170	XLent Software	56ST, 98

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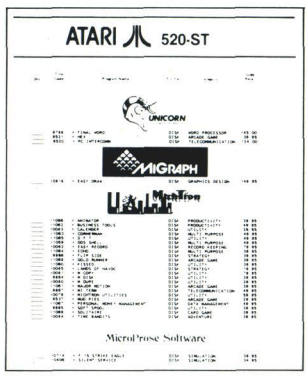

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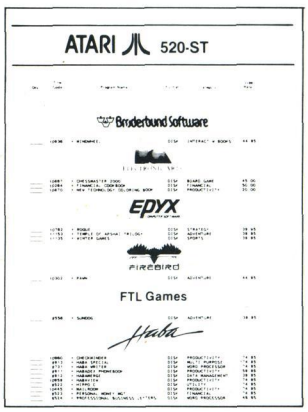

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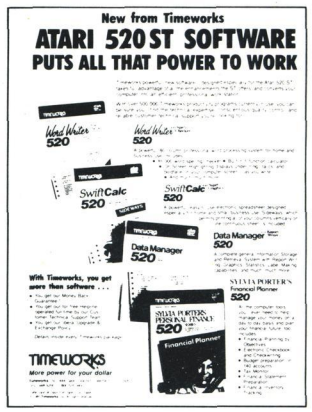

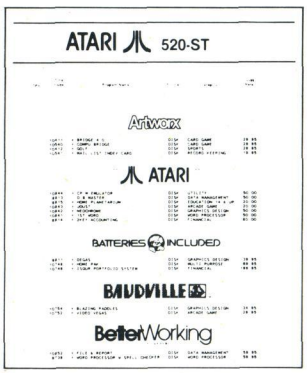

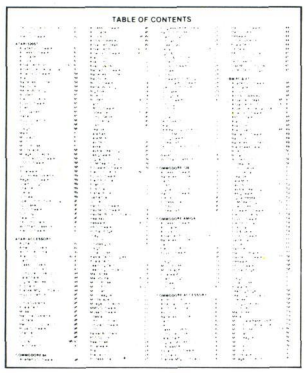

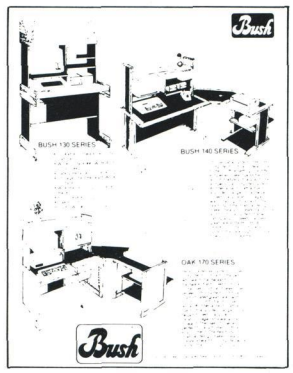

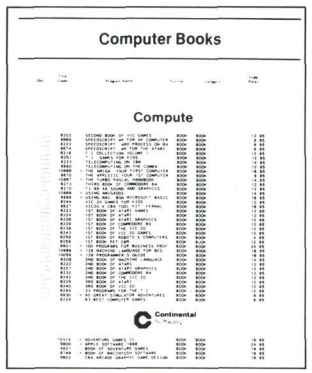

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